

# Improving and Expanding Solid Waste Collection in Manado, North Sulawesi, Indonesia



## Final Solid Waste Management Plan: Collection Strategies

January 2004



LAG-I-818-99-00009-00  
Task Order 818, SUM IQC

**Research Triangle Institute (USA)**  
In association with  
PT Deserco Development Services



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## **Section 1**

### **Executive Summary**

Solid waste management (SWM) is one of the most visible services provided by local governments. In particular, ineffectual solid waste collection can lead to easily observable conditions such as extensive litter and random accumulations of solid waste along roadways, in drainage channels and on vacant land. In Manado, solid waste problems have been attributed to a number of factors including:

1. Low public awareness and discipline,
2. Insufficient transport vehicles for effective collection,
3. A lack of appropriate technology in its collection system,
4. Insufficient or improperly collected fees to sustain an effective program, and
5. No law enforcement that prevents littering or indiscriminate dumping of solid waste.

The City of Manado has an added interest in its solid waste problems since the perception of dirty streets or the presence of solid waste at the Bunaken National Marine Park can have a major impact on tourism. Manado is seeking to correct its solid waste management problems at a time when it has decentralized its solid waste collection program to the kecamatan that make up the city. Through a decision by the Mayor, the solid waste collection service is now provided primarily by the kecamatan through trucks and personnel delegated to them for that purpose.

With a population of about 420,000 people, Manado generates about 1,149 cubic meters per day of residential solid waste. Solid waste is also generated from commercial and institutional sources. To a lesser degree, a small quantity of solid waste is generated from the limited number of industrial sources in Manado. Only about 60% of the residential solid waste is actually collected and transported to the City's Sumompo disposal area.

As is the case in many cities throughout the world, the solid waste collection system in Manado consists of a primary and secondary process. In the primary process, solid waste generators bring their waste to communal collection points (TPS or containers) where it is deposited. In some locations in the city, primary collection is accomplished through door-to-door collection provided by village administration or private micro-enterprises. The secondary collection process provides transportation of the solid waste from the communal collection points to the disposal site. This is accomplished primarily by each kecamatan with the trucks and personnel. Some secondary collection is accomplished by the City's solid waste agency through the deployment of containers in the downtown area of the City. In addition, a Chinese association (Tionghoa) provides collection in seven of the city's eight kecamatan as a public service.

Local regulations that govern solid waste management (SWM) in Manado provide a basis for user fees that must be paid for SWM services. User fees charged for SWM services are based on the type of housing or enterprise (office, etc.) from which the solid waste is generated. Solid waste fees are currently collected through electricity bills. Typically, the fees collected are considerably less than the cost of providing the services.

Deficiencies that exist in the current collection system in Manado include the following:

**Technical/Operational Deficiencies**

1. Improper TPS design and configuration
2. Excessive distance to TPS or containers for residential and small scale commercial generators
3. TPS locations on or adjoining drainage structures
4. Insufficient collection equipment and personnel
5. Lack of collection routing standardization and efficiency
6. Inability to collect solid waste in the densely populated areas

**Economic/Financial Deficiencies**

1. Inadequate level of service funding
2. Budgetary process not tied to performance
3. Insufficient revenues and cost recovery
4. Insufficient financial resources for collection program expansion or for new equipment and technology

**Legal/Institutional Deficiencies**

1. Lack of planning
2. Lack of coordination between all parties involved in swm
3. Lack of enforcement
4. Inadequate public awareness

Greater detail on the cause of each of these deficiencies is presented in the report. There are a number of overall strategies that have been used to overcome the above deficiencies. To develop an effective strategy, a number of recommendations have been made to address the above issues and to improve solid waste collection in the future. These are presented in the table shown on the following page. As shown the recommendations are aimed at all of the parties responsible for elements of the overall solid waste collection program in Manado.

The project defined in this report intends to provide a strong element through use of the “Lestari” process developed as a result of the Natural Resources Management (NRM) project in Manado. This multimedia public information approach will provide information to the residents of Manado through a variety of media including newspaper, television, etc. In addition, the project will help to build the technical capacity of the various participants, particularly kecamatan and kelurahan officials. This will be accomplished through development of a primer on collection and service assessment. Pilot projects to demonstrate key recommended procedures and workshops to explain the basis for recommended approaches will also be developed.

## SOLID WASTE COLLECTION IMPROVEMENT STRATEGIES

PARTICIPANT	OBJECTIVE	STRATEGY
<b>Solid Waste Generator</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Eliminate illegal dumping and litter</li> <li>✓ Use TPS/containers in the correct manner</li> <li>✓ Participate in regular neighborhood cleanups</li> <li>✓ Pay reasonable fees for service</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Accept and be subject to greater enforcement</li> <li>✓ Increase public awareness of the consequences of SWM issue</li> <li>✓ Accept increased fees linked to better service</li> <li>✓ Adopt reasonable standards for the manner in which their solid waste is stored packaged and transported to collection points</li> <li>✓ Participate in City , Kecamatan and Kelurahan sponsored SWM programs</li> <li>✓ Participate in regularly scheduled clean - up programs</li> </ul>
<b>Kelurahan/ Lingkungan</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater control of solid waste conditions in their jurisdictions</li> <li>✓ Implementation of door to door collection</li> <li>✓ Clean-up of drainage channels and courses</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Accept responsibility for primary collection in the kelurahan and lingkungan</li> <li>✓ Increase knowledge and capacity to evaluate SWM issues</li> <li>✓ Perform needs analysis of their districts and subdistricts</li> <li>✓ Establish cost effective and sustainable door to door collection for their districts</li> <li>✓ Recommend and implement new collection points in conjunction with kecamatan</li> <li>✓ Develop special programs for areas with special problems such as densely populated poor areas or riverfront areas</li> <li>✓ Sponsor (along with Kecamatan ) annual clean -up of district and drainage structures</li> <li>✓ Implement recycling and compost programs</li> </ul>
<b>Kecamatan</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater coordination with Kelurahan and BPK</li> <li>✓ Increased collection efficiency</li> <li>✓ Clean-up of drainage channels and courses</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Increase capacity to evaluate SWM collection issues</li> <li>✓ Develop 5 year plan for collection system improvements in conjunction with BPK</li> <li>✓ Perform needs analysis for their collection program in conjunction with Kelurahan level needs analysis</li> <li>✓ Establish full cost operating budget for solid waste collection function under their jurisdiction</li> <li>✓ Support Kelurahan special programs for areas with special problems such as densely populated poor areas and riverfront areas</li> <li>✓ Sponsor and support (along with Kelurahan) annual clean-up of district including drainage structures</li> <li>✓ Perform service needs assessments in coordination with each kelurahan</li> <li>✓ Assist the kelurahans in performing needs assessment for their subdistricts</li> <li>✓ Increase number of TPS containers locations and collection equipment to service them</li> <li>✓ Evaluate and implement just-in-time or block collection</li> </ul>
<b>Municipality</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater coordination with Kecamatan</li> <li>✓ Improved infrastructure planning</li> <li>✓ Development of common performance standard throughout City</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Revise and update 5 year plan to action mode</li> <li>✓ Develop reasonable and sustainable level of SWM performance by Kecamatan</li> <li>✓ Monitor and report SWM performance by participants on regular basis</li> <li>✓ Assist the kecamatan in providing technical assistance to their kelurahans</li> <li>✓ Establish full cost operating budget for solid waste function under their jurisdiction</li> <li>✓ Implement reasonable cost recovery programs</li> <li>✓ Support special programs for areas with special problems such as densely populated poor areas and riverfront areas</li> <li>✓ Sponsor and support (along with Kecamatan and Kelurahan ) annual clean-up of district including drainage structures</li> <li>✓ Support and push for greater enforcement of existing laws and regulations</li> <li>✓ Develop and implement ongoing public awareness programs relative to solid waste management</li> <li>✓ Provide support for recycling and compost programs</li> <li>✓ Construct transfer depots that may serve more than one Kecamatan</li> <li>✓ Locate and implement new TPA on opposite sides of City</li> <li>✓ Provide technical assistance and coordination to kecamatan for local needs assessments and capacity building</li> </ul>

## Section 2

# Introduction

Solid waste management (SWM) is one of the most visible services provided by local governments. In particular, ineffectual solid waste collection can lead to easily observable conditions such as extensive litter and random accumulations of solid waste along roadways, in drainage channels and on vacant land. In addition to the general public sentiment that there is “garbage in the streets”, it can also lead to feelings that collection services are not worth paying for or that increased charges should not be politically supported because of poor levels of service derived from current payments. Often, solid waste problems are not caused by a lack of concern about the issue but may be due to a lack of resources and capacity (technical and financial) to keep up with the quantity of solid waste generated from residential, commercial and industrial sources. The Mayor of Manado has publicly acknowledged that the City’s solid waste management program has a number of problems including:

1. Low public awareness and discipline,
2. Insufficient transport vehicles for effective collection,
3. A lack of appropriate technology in its collection system,
4. Insufficient or improperly collected fees to sustain an effective program, and
5. No law enforcement that prevents littering or indiscriminate dumping of solid waste.

These are the root causes for most solid waste problems experienced in any city across the world. Public officials in cities such as Manado are searching for the means to increase and subsequently maintain the efficiency of their solid waste management programs to eliminate (or, at least, minimize) their solid waste problems. This usually requires that each of the above deficiencies be addressed in an effective and sustainable manner.

The City of Manado faces another important consideration in assessing its solid waste problems. Solid waste reaching Manado Bay (shown in Picture 2.1 on page 9) can affect the view and experience of visitors who come to Manado to enjoy its natural environment and

### **Bunaker Clean-up Project**

A clean-up project was undertaken in the vicinity of the Bunaken National Marine Park in October 2003. About 4.4 tonnes of solid waste were collected as a result of the clean up effort. Some of this material is shown in Picture 2.2 on Page 9. While some of this material may have been direct litter from dive operations and from boats traveling between Bunaken and Manado, a significant portion of it may have also originated from the City of Manado as a result of the existing problems with the city’s solid waste collection programs.

resources. The region’s most important tourist draw (the Bunaken National Marine Park) can be affected by solid waste that reaches Manado Bay to a point where the region’s tourism economy may be threatened. Due to natural currents within the bay, solid waste components (such as plastic containers and bags, etc.) can eventually make their way to the vicinity of the marine park thereby tainting its natural pristine condition.

In addition to the above, Manado’s solid waste collection service is in a state of transition. In 2001, the Mayor of Manado decentralized a portion of the City’s municipal program by



placing primary responsibility for solid waste collection and transport from temporary storage locations (TPS) and other collection points on the 9 kecamatan that make up the City governmental district structure. Through this decentralization, equipment and personnel were transferred to the jurisdiction of each kecamatan through which they are to provide collection and transport of municipal solid waste (MSW) generated within their districts. This process, along with the overall national decentralization of many public services and responsibilities to the local level, has resulted in a new vantage point by which solid waste management issues in Manado must be addressed.

This report is intended to contribute to the improvement of solid waste management and particularly collection services in Manado. This will be accomplished by increasing the knowledge of the manner in which improvements can be made within the context of the existing economic, planning and development constraints that exist in Manado.

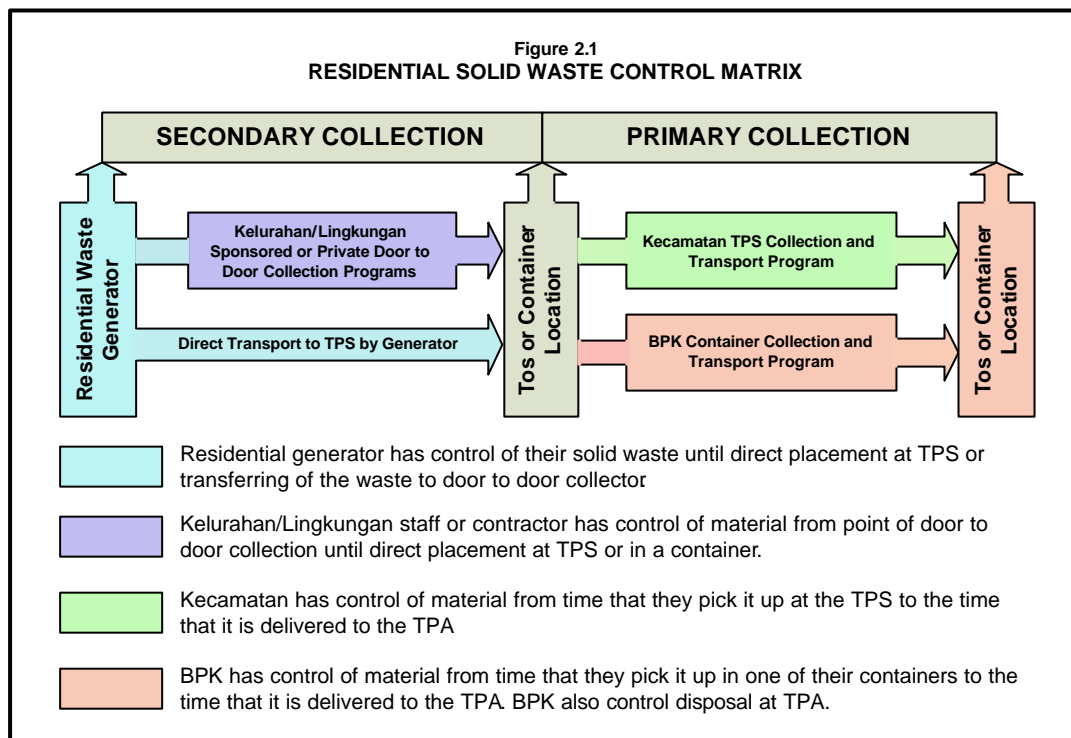
## 2.1 Project Goals and Objectives

The primary goal of this project is to improve and expand solid waste collection within the City of Manado. While proper solid waste disposal is also an issue in the City and there are a number of significant environmental and health issues associated with current disposal locations and practices, it is not the primary focus of this project and report. The physical characteristics (location and operating conditions) of the existing disposal sites (TPA) are incorporated into the parameters of this report only to the extent that they affect the efficiency of solid waste collection. The key objectives of this project attempt to:

1. Define the specific institutional/legal, technical/operational and economic/financial issues and constraints that must be addressed to achieve solid waste collection improvement and a reasonable, sustainable level of service.
2. Assist in the categorization and quantification of the technical (equipment and personnel) resources required to achieve and sustain a desired level of collection service.
3. Define ways in which existing resources and programs can be better utilized to increase the level and efficiency of service without significant additional cost.
4. Increase the knowledge of the people responsible for solid waste collection at the various levels of government particularly those at the kecamatan and kelurahan district level who have just recently inherited this responsibility.
5. Enhance the manner in which solid waste management planning and administration can be accomplished at the City, kecamatan and kelurahan and lingkungan levels of government and administration.
6. Help to define a role that community based organizations (CBOs) can have in an effective integrated solid waste management program.

Fundamental to the above objectives is the need to keep all solid waste generated within the City within a **controlled process** from its source (residential, commercial, etc.) generation to final disposal. This means that, to the degree possible, solid waste should remain under the control of the various parties involved in its management from its point of generation until final placement in the disposal area or until diversion from the SWM program through recycling or compost initiatives. An effective SWM program must place the burden of responsibility on each participating party who, at a minimum, include: 1) the generators who create the waste in the first place and must carry their solid waste to a TPS location or set it out for door to door collectors, 2) public or private sector collectors who may pick up the waste door to door and transport it to a TPS or container location, and 3) the kecamatans or Manado's solid waste management agency (Badan Pengelola Kebersihan Kota Manado

or BPK) personnel who are responsible for picking up the solid waste from various collection points and transporting it to the disposal sites. The responsible parties are shown in the Control Matrix Schematic in Figure 2.1. This schematic also presents the general classification of collection services as either primary or secondary collection. This classification is used throughout this report in defining the level of services required. This categorization of the overall collection process is warranted since the responsibility for each service category will, more than likely, rest with different groups or agencies. The Control Matrix schematic also emphasizes the importance of the point where solid waste goes from



the primary to the secondary system. **This design of this interface is very important in the success of the SWM program.**

Solid waste that ends up in drainage structures (as shown in Picture 23 on Page 9) or as waste piles on vacant land or along roadways exists in those locations because it has fallen out of the control of the collection program participants. This project attempts to minimize the solid waste that falls out of the control of the formal collection program (through both its primary and secondary collection processes) by increasing the voluntary or forced effectiveness of each participant in the SWM program.

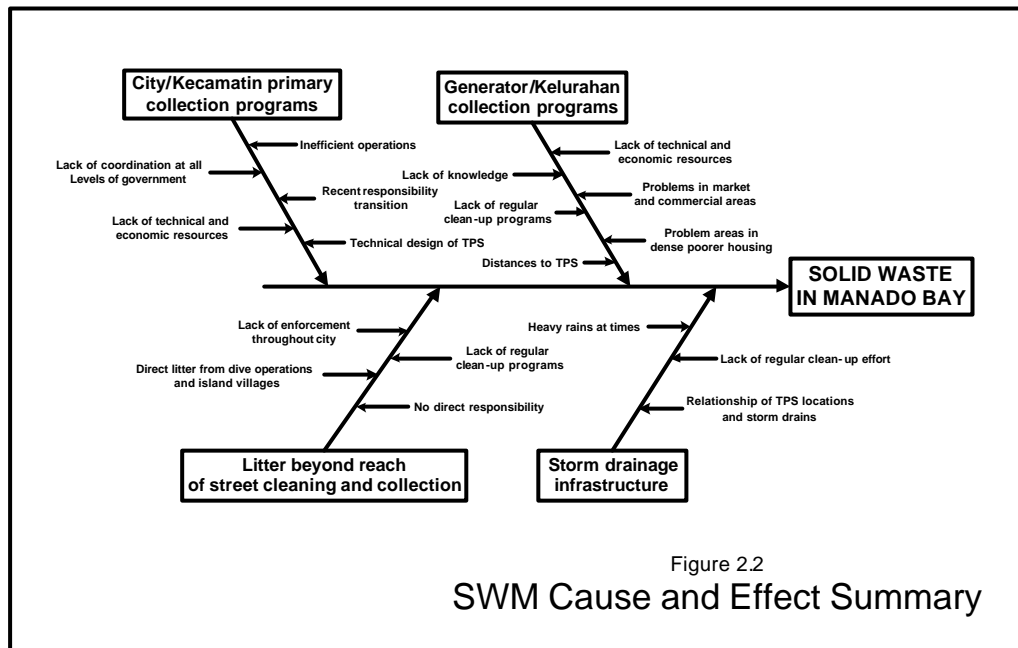
Eventual increased enforcement of reasonable laws and regulations preventing littering or illegal dumping must also be part of the overall SWM strategy if improved conditions are to be fully realized. This will help to assure that all waste generators live up to their responsibility in managing their own waste materials until it enters the formal solid waste management program.

In addition, reactive efforts such as the physical clean-up of drainage channels and illegal solid waste accumulations (or regularly scheduled programs such as the aforementioned Bunaken clean-up project) should be an ongoing part of the City's overall solid waste management program. If successful, a proactive improvement of solid waste collection efficiency at all levels (generator, kelurahan, kecamatan, City, etc.) should help to

eventually minimize the need for regular clean-up efforts in the future. While the ideal situation would be to have such an efficient program that there would never be a need for periodic clean-up, the reality is that such programs will, more than likely, be part of the overall management of the City's environment in the future. This is consistent with experience throughout the world.

## 2.2 Existing Solid Waste Management Problems In Manado

The general causes of solid waste problems in Manado and the presence of solid waste in Manado Bay are shown in the Cause and Effect Diagram presented in Figure 2.2.



Many of the causes shown in the diagram are due to the general ineffectiveness of the current solid waste collection program in Manado. This ineffectiveness is influenced by a number of factors, including:

1. **Inefficient, labor-intensive solid waste collection** that only collects about 60% of the solid waste generated in the region.
2. **Insufficient and poorly designed or located TPS** which serve as the interface between the primary and secondary collection processes. (Because of the distance that many generators must carry their solid waste to reach a TPS, many opt to simply drop their solid waste at roadside. These locations then become informal collection points that must be addressed by the kecamatan collection staff thereby affecting the overall efficiency of their collection effort.)
3. A general **lack of enforcement of rules and regulations** governing littering and the indiscriminate dumping of solid waste such as that shown in Picture 2.4 on page 9).
4. **Difficulties in collecting solid waste from densely populated housing areas** inaccessible to collection vehicles. (There are a number of informal settlements along the banks of the rivers flowing through the city that are not adequately served by a formal collection program. As a result, a common practice for residents in these areas is to simply dump their solid waste into the rivers or discard it along the riverbanks. Solid waste deposited along the riverbanks is periodically “flushed” to the Bay during the wet

season or during any significant storm event thereby potentially serving as a major contributor to the solid waste in the water off the Manado shore.)

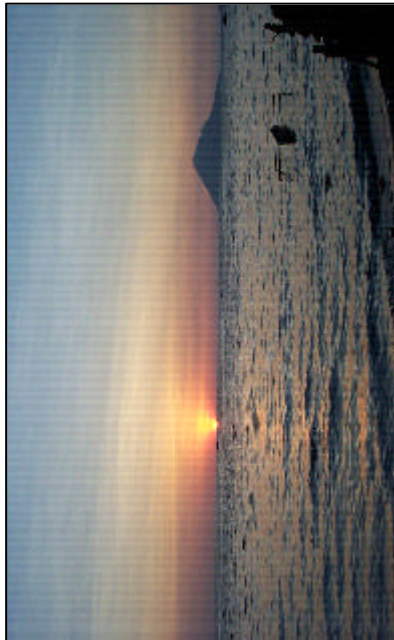
5. The **country's recent economic crisis** where less money is now available to municipalities to provide basic services including solid waste management.
6. **Rapid government decentralization** which has made it more difficult for local governments to provide fundamental public services that must all compete for limited financial resources.
7. **Increasing population and urbanization** leading to an increasing amount of solid waste generation at a time when the funds available to provide municipal services are not keeping pace or even decreasing.
8. A **rapid influx of refugees** that generate solid waste especially into areas of the city that are not adequately served by the City's formal solid waste management programs.
9. **Difficulties in increasing or collecting fees** associated with solid waste management because of the perception by the public of the poor level of service currently provided or that basic local services such as door to door collection at the Kelurahan level should be covered by the fees that they already pay.

### 2.3 Potential Effect On Tourism Industry

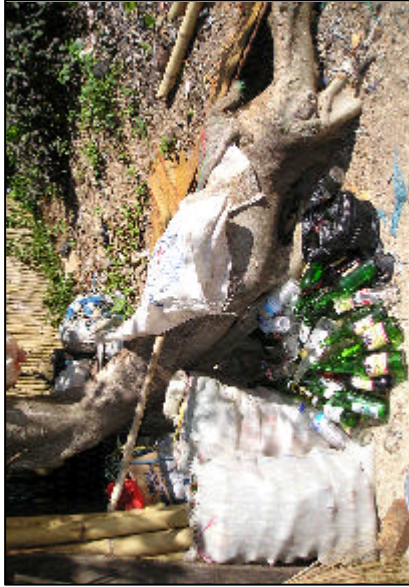
Solid waste collection problems can have a significant effect on the tourism industry and dive operators in the region. This is especially the case in Manado where people from all over the world have traveled to Manado to experience its dive centers and the natural beauty of the Bunaken National Marine Park. Success in tourism is often based on all aspects of a tourist's experience in the area and on their descriptions of that experience to other's considering travel to Manado.

In recent years, it has been reported that many tourists coming to Manado have expressed dismay about the presence of solid waste in Manado Bay especially in the vicinity of the Marine Park. These conditions may lead to a choice not to return to the region in the future or to pass along their impression of conditions to others who may then choose not to come to Manado. Forms of electronic communication such as travel internet sites provide the means by which people can make their views known of a particular travel destination to an extensive number of people. As a result, increasing awareness of the solid waste problems in Manado can have a devastating effect on the local economy as a result of a loss of money in all tourism and travel sectors (dive centers, transport, lodging, restaurants, shops, etc.). This provides a direct economic basis for seeking to improve SWM in Manado and may serve as catalyst for increasing revenues for a better level of service. It may also provide a basis by which to seek assistance from Manado's business community in helping to fund special programs such as annual clean-up programs.

Picture 2.1  
Manado Bay



Picture 2.2  
Solid Waste Recovered  
During Bunaken Cleanup Project



Picture 2.3  
Solid Waste Along Road and in Drainage Structure



Picture 2.4  
Solid Waste Along Manado Waterfront



## Section 3

# Background

### 3.1 Demographics and Locale

The Manado region is generally hilly and mountainous with a narrow coastal plain fronting the Sulawesi Sea. The region as a whole is volcanic in origin with the extinct Klabat volcano its most important landmark. As a result, water catchments areas within the City are relatively steep and short and the region is generally prone to flooding in the rainy season which normally occurs from November to March. There are five rivers flowing through the City namely the Tondano River, Malalayang River, Sario River, Bailang River and Wusa/Paniki River. The general physical characteristics of Manado have a significant effect on the amount of solid waste that may reach Manado Bay in that solid waste material accumulated in drainage channels or in flood prone areas can be washed into the bay due to the high velocity of water that can flow through the steep drainage channels and courses during rain events.

Manado, with a population of about 420,000 people and a land area of about 2,922 km<sup>2</sup> is, by Indonesian standards, classified as a small city. Like many of Indonesia's municipalities, however, it is growing faster than the city's infrastructure can keep pace with. The average population growth rate for the last 10 years is about 3 %.

Bunaken National Marine Park lies partly within the City of Manado and partly in Kabupaten Minahasa. Bunaken Island and Manado Tua Island are within the city limits and are part of one of Manado's "urban" kecamatan (Kecamatan Bunaken). Bunaken Island has 3,417 permanent residents on an island of 704 ha while neighboring Manado Tua Island has a population of 2,698 permanent residents on an area of 1,040 ha. These population levels do not include the influx of tourists that stay mainly on Bunaken Island in home stays.

Manado is not a significant commercial or industrial center for the region. Its harbor, which is small, silted up long ago for deep draft vessels. (North Sulawesi's main port is in the smaller city of Bitung which is located 54 kilometers from Manado on the eastern part of the peninsula.) However, Manado is the provincial capital and the center for administrative, educational, cultural and service industries (especially the important tourist industry centered on Bunaken). It is also the main market for rural North Sulawesi. Because of this, Manado is economically important to the region.

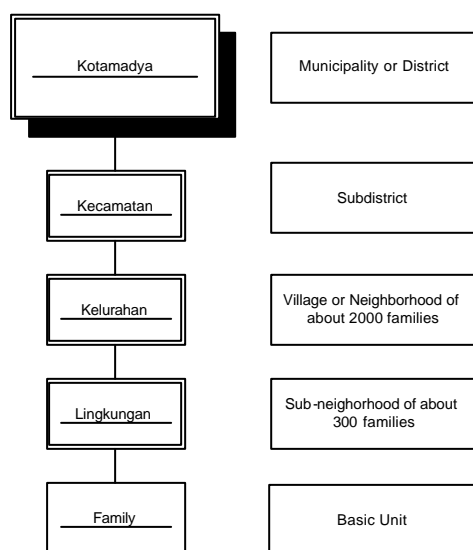


Figure 3.1  
City of Manado Administrative Structure

Manado is subdivided into a number of smaller administrative units or districts. Below the municipal level, various subdivisions exist that are generally determined by population. The hierarchical structure of these smaller administrative units is shown in Figure 3.1. Each of these administrative levels has or should have an important role in Manado's SWM program. Additional information concerning each administrative level of governance and their role in solid waste management is shown below:

- **Kotamadya:** The City of Manado, through its solid waste management agency (Badan Pengelola Kebersihan Kota Manado or BPK), currently operates a part of the collection system in the City through the placement and use of roll-off type containers placed in various locations within the City particularly in the downtown commercial district. BPK is also responsible for the operation of the City's disposal sites. In 2000, the Mayor of Manado, through the Mayor's Decree #136, implemented a plan to decentralize the management of solid waste collection from the BPK to the nine kecamatan and to the kelurahan level of government. In a subsequent decree, the Mayor gave BPK the responsibility to plan and monitor performance of various SWM processes including those that were divested to the kecamatans.
- **Kecamatan:** This level of government (with a government-appointed head) is the principal subdistrict of the City. Based on the aforementioned Mayor's decree, the kecamatan level of government is now responsible for coordination of the primary SWM carried out at the kelurahan level and for secondary collection and transport of solid waste from their districts to the disposal sites. Basic demographic for each kecamatan is shown in Table 3.1. The locations and configurations of each kecamatan are shown in Figure 3.2 on the following page. In addition, individual demo-graphic and SWM profiles for each of the 9 kecamatan are presented in Annex B.

Table 3.1  
Kecamatan Demographics

No.	Kecamatan	Number of Kelurahan	Population <sup>1</sup>	Area (ha)
1	Malalayang	9	54,544	1,721
2	Singkil	9	46,865	389
3	Wanea	9	58,367	112
4	Wenang <sup>2</sup>	12	41,536	280
5	Sario	7	26,649	145
6	Tuminting	10	49,648	489
7	Mapanget	11	49,500	5,922
8	Tikala	12	70,867	1,681
9	Bunaken <sup>3</sup>	8	21,712	5,125
	<b>Total</b>	<b>87</b>	<b>419,688</b>	<b>14,143</b>

Notes

- 1 Population based on data from each kecamatan
- 2 Includes Senggol marketplace
- 3 4 Bunaken kelurahan on Bunaken Island and 4 in Manado City

- **Kelurahan:** This is the administrative level where, under the mayor's decentralization program, LPMs (community councils) will take over some of the responsibility for solid waste collection within their individual districts. The number of kelurahan in each of Manado's kecamatan is shown in Table 3.1. Variation in the physical and demographic characteristics of the different districts (road access, topography, distance to TPS and TPA locations, housing density, level of income, etc.) affect the manner in which solid waste is collected in each kelurahan.
- **Lingkungan:** Each kelurahan is subdivided into smaller units. In Manado, these smaller units are called Lingkungan and are similar in function and structure to the Rukun Warga (RW) as they are identified in other parts of Indonesia. Each of these administrative units covers about 300 families.
- **Household:** This is the basic participatory level in the current SWM program. Individual households are the generators of most of the MSW in Manado and, in the present system, are responsible for its transport to the TPS consolidation locations.

Each of the above is important to the proper management of solid waste in Manado. It is also anticipated that they should also have a major role in the future. As a result, any strategic plan designed to improve SWM in Manado must address specific issues that are relevant to or the responsibility of each participant including, in particular, solid waste generators.

In addition to the above, community-based organizations (CBOs) and NGOs may also have a relevant future role in Manado's SWM program. Historically, CBOs such as



neighborhood committees, women's groups, youth groups, religious organizations, and political groups have participated in solid waste management programs. NGOs have served as facilitators and advocates of SWM initiatives and have provided valuable inputs such as information, technical advice, finances, equipment and facilities in support of locally based programs.

### 3.2 Recent Solid Waste Initiatives and Projects in Manado

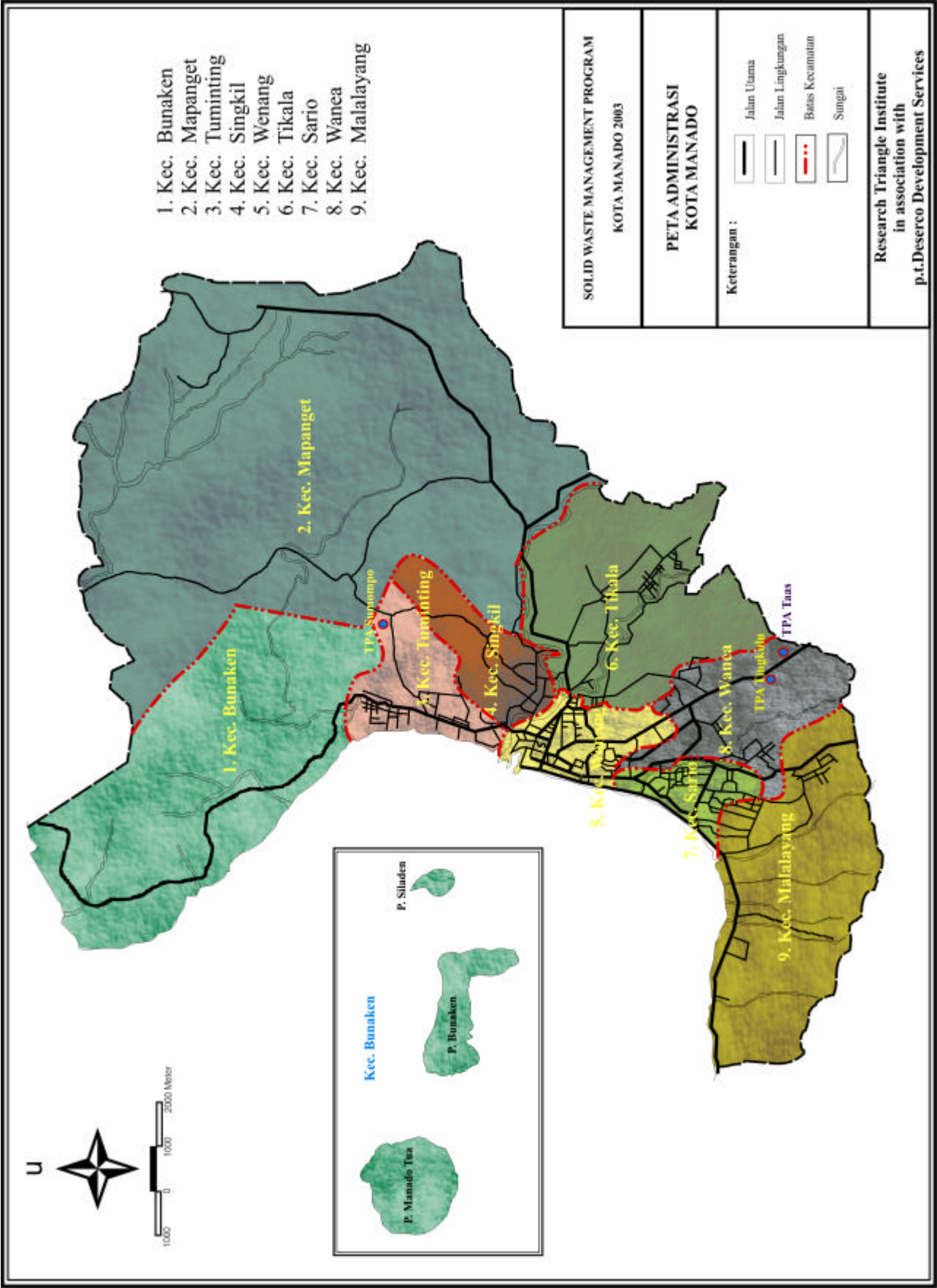
There have been recent solid waste management initiatives that provide background concerning existing SWM practices in Manado as well as the City's vision for the future.

1. **The Capacity Building in Urban Infrastructure Management Project** – This project, sponsored by the Asian Development Bank, included a pilot area program element aimed at solid waste management in Manado. This program provided an analysis of the current level of SWM after decentralization of the basic collection process to the Kecamatan and smaller district level of government in the City.
2. **The BPK Strategic 5 Year Plan** - In 2000, the City of Manado through the BPK formulated a Strategic Plan as a basic reference for development of its solid waste management program over a 5 year period from 2000 to 2005.

#### **Effects of Decentralization on Public Services Including Solid Waste Collection**

Indonesia's decentralization process has led to the transfer of implementation, operations and maintenance functions from the national government to lower, more local levels of government. The process of devolution of authorities and responsibilities for governance began with the passage of two basic laws in 1999 (U.U. #22 on the transfer of authorities to regions and U.U. #25 on fiscal decentralization). These laws were passed as a result of a push toward political reform. Because of political pressures, the decentralization legislation provided for a very short (about 18 months) period of preparation and legal/regulatory transition before full decentralization would take place on January 1, 2001. Because of this short time span, there were difficulties in bringing regional and local governments (which had little or no previous experience with their own governance and resource management) up to speed in terms of management capacity, fiscal responsibility, legal and regulatory reforms and the evolution of basic planning abilities. Compounding this short transition period was the fact that it was occurring during a time of political and economic crisis throughout the country in which local tax revenues and foreign/domestic investment were significantly reduced. As a result, the immediate impact of rapid decentralization has, among other things, created a general deterioration in many public services including solid waste management.





### 3.3 Solid Waste Generation In Manado

There are different types of solid waste generated in Manado including solid waste generated from residential, commercial, institutional and industrial sources. Each of these solid waste forms must be managed effectively. The relative amounts of each type of waste generated in Manado depend on a number of factors such as population, the level of industrialization, etc. The physical characteristics of these waste forms are a function of the processes that are involved in their generation. The following generally characterizes each waste stream in Manado.

**Residential Solid Waste** – The quantity of residential solid waste is usually a function of the number of people and households generating the waste. Factors such as family income and location (rural versus urban) also have an effect on the unit amount and components of solid waste generated by people that live in Manado. Manado has a population of about 420,000 people that reside in about 81,892 households. (This yields an average household size of about 5.1 people.) Manado's population is growing at a rate of about 3% per year based on data for the last ten years. In recent years, population growth has also included an influx of about 11,000 people who migrated from Maluku to Manado since the end of 1999 because of political unrest. The surrounding Kabupaten Minahasa had a population of 249,886 in an area of 79,876 square kilometers. However, much of the solid waste generated by people living outside of the urban areas of Manado is managed on site through direct burial or burning.

It is estimated that the residential solid waste generated in Manado is about 1,149 cubic meters per day. Table 3.2 presents the estimated amount of solid waste generated in each kecamatan along with an estimate of the amount of solid waste actually collected by kecamatan personnel. The assessment of the actual quantity of solid waste collected is based on an analysis of collection records from each kecamatan and the BPK. In addition to the

<b>Kecamatan</b>	<b>Waste Generated (m<sup>3</sup>/day)</b>	<b>Waste Collected (m<sup>3</sup>/day)</b>	<b>% Collected</b>	<b>Collection Points</b>	<b>Trips to TPA (times/day)</b>
Malalayang	136	80	59%	50	8
Singkil	117	32	27%	28	4
Wanea	146	64	44%	44	6
Wenang	204	162	80%	120	15
Sario	67	64	96%	37	6
Tuminting	124	45	36%	33	6
Mapanget	124	16	13%	28	2
Tikala	177	62	35%	35	7
Bunaken	54	13	24%	22	2
BP Kebersihan		112		18	16
Tionghua		44			6
<b>Total</b>	<b>1149</b>	<b>694</b>	<b>60%</b>	<b>415</b>	<b>78</b>

kecamatan collection programs, BPK provides some collection services through the deployment and management of a container-based system generally serving the downtown area of the City. It is estimated that BPK collects about 112 cubic meters per day that originate from various sections of Kecamatan Winang and Sario. A Chinese Association (Tionghoa) also provides some solid waste collection in seven of Manado's kecamatan. They utilize two trucks that each collects about 22 cubic meters of solid waste per day. Based on the collection coverage shown in Table 3.2, the overall collection rate in the city is about 60% with the highest collection rates in the downtown districts such as Kecamatan

Wenang (80%) and Kecamatan Sario (96%). As expected, the lowest collection rates occur in the larger outlying districts such as Kecamatan Mapanget (13%) and Kecamatan Bunaken (24%) which have extensive rural areas not serviced by a formal collection program. In the rural areas of the city, onsite disposal through burial or burning is a common practice.

The total residential solid waste stream is anticipated to increase in volume at a rate consistent of future increases in population. Projected population in Manado in 2025 is over 800,000 people if the current annual growth rate of 3% is maintained. Failure to improve or expand the solid waste management programs in the City now could lead to a greater amount of litter and illegal dumping in the future as the quantity of residential solid waste to be managed grows. (This growth impact can be somewhat mitigated through the development of recycling and composting programs that can help to divert waste components from the quantity to be collected.)

**Commercial Solid Waste** - Commercial solid waste collection is also problematic in Manado since businesses span a wide spectrum from small food stalls and kiosks to large businesses such as hotels and shopping centers. For the most part, Manado's commercial solid waste is handled in the following manner:

- Large businesses such as shopping centers and hotels generally provide their own means for transferring their solid waste to the disposal locations. For example, major shopping centers in Manado such as Coco Gran Puri (3 cubic meters per day), Matahari (2 cubic meters per day) and Bahu Mall (10 cubic meters per day) manage their own waste streams and transport their solid waste to the TPA with their own staff and equipment. The new major development projects along Manado's waterfront will create a significant amount of new commercial space in Manado. This will, more than likely, increase the amount of commercial solid waste generated in the city.
- Formal market areas in Manado (shown in Table 3.3) are managed by PD Pasar, the municipal agency responsible for market infrastructure in Manado. This agency provides containers for solid waste generated at the markets. On a regular basis, PD Pasar transports the waste placed in the containers to the TPA using its own arm roll truck. The agency picks up containers from the Pinasungkulan and Orde Baru markets on one collection route and that from the remaining three markets on another. While it is estimated that about 206 cubic meters per day is generated in the market areas, only about 65% of it is accounted for through the PD Pasar collection program. The Senggol market within Kecamatan Wenang is serviced by BPK and comprises a portion of the waste shown for that kecamatan in Table 3.2.

<b>Market</b>	<b>Waste Generated (m<sup>3</sup>/day)</b>	<b>Waste Collected (m<sup>3</sup>/day)</b>	<b>% Collected</b>	<b>Collection Points</b>	<b>Trips to TPA (times/day)</b>
Pinasungkulan	61	44	72%		3
Bersehati	49	37	76%		5
Orde Baru	54	26	48%	2	
Tuminting	21	12	57%	1	
Bahu	21	14	67%	1	
<b>Total</b>	<b>206</b>	<b>133</b>	<b>65%</b>	<b>4</b>	<b>8</b>

- Small commercial waste generators place their solid waste at nearby TPS or simply pile it near their businesses. The evaluation team believes that small commercial operators collectively may generate a significant portion of the uncollected wastes in the City that reaches Manado Bay. This material includes a large proportion of plastic bottles and

bags which are very mobile and may be an important source of the solid waste that reaching the bay.

**Industrial Solid Waste** – The City of Manado does not have a significant industrial base. There are no major industries that generate industrial solid waste. There are currently 22 entities that are charged annually through the Retribusi program in its industrial category. The companies, shown in Table 3.4, that are classified in the industrial category include a number of businesses that are clearly not industrial facilities. As shown in Table 3.4, hotels are also included as well as storehouses that would not generate **production waste**.

<b>No.</b>	<b>Type of Business</b>	<b>Address</b>	<b>Fee (Rp.)</b>	<b>Classification</b>
1.	Hotel Santika <sup>1</sup>	Kel. Tongkaina	1,800,000	large industry
2.	Madu Rasa Wine Factory	Kel. Wawonasa	1,200,000	small industry
3.	CV. <sup>2</sup> Berkah Rejeki	Kel. Islam	1,200,000	small industry
4.	CV. Anugrah Genteng	Kel. Paal IV	1,200,000	small industry
5.	CV. Central Bukit Maria	Kel. Singkil I	1,200,000	small industry
6.	Jaya Bread maker	Kel. Pinaesaan	1,200,000	small industry
7.	New Queen Hotel <sup>1</sup>	Kel. Wanea Utara	1,200,000	small industry
8.	Minahasa Ice factory	Kel. Pinaesaan	1,200,000	small industry
9.	Wine factory	Jl. S. Parman	1,200,000	small industry
10.	Usaha Baru Plastic Factory	Kel. Singkil	1,200,000	small industry
11.	Sumber Wine Factory	Kel. Ranotana	1,200,000	small industry
12.	PT. Garuda Pertiwi storehouse	Kel. Islam	1,200,000	small industry
13.	Kebesaran Wine factory	Kel. Maasing	1,500,000	medium industry
14.	CV. Alim Usaha Rejeki storehouse	Kel. Lawangirung	1,200,000	small industry
15.	Serasa Wine Factory	Kel. Tuminting	1,200,000	small industry
16.	PT. Manguni Garden/Hotel Sahid <sup>1</sup>	Kel. Teling Atas	1,800,000	large industry
17.	Gran Puri Hotel <sup>1</sup>	Kel. Ranotana	1,800,000	large industry
18.	PT. Setia Trijaya	Kel. Kombos Timur	1,800,000	large industry
19.	TO. Sidodadi Motor storehouse	Kel. Tuminting	1,800,000	large industry
20.	PT. Nassindo Sinar Pratama	Jl. Cereme Kel. Islam	1,800,000	large industry
21.	Sincky Bakery (bread maker)	Kel. Kombos Timur	1,500,000	medium industry
22.	Super white foam factory	Kel. Islam	1,200,000	small industry

Notes:

1 Hotels

2 CV is a privately and individually owned company; no shareholding

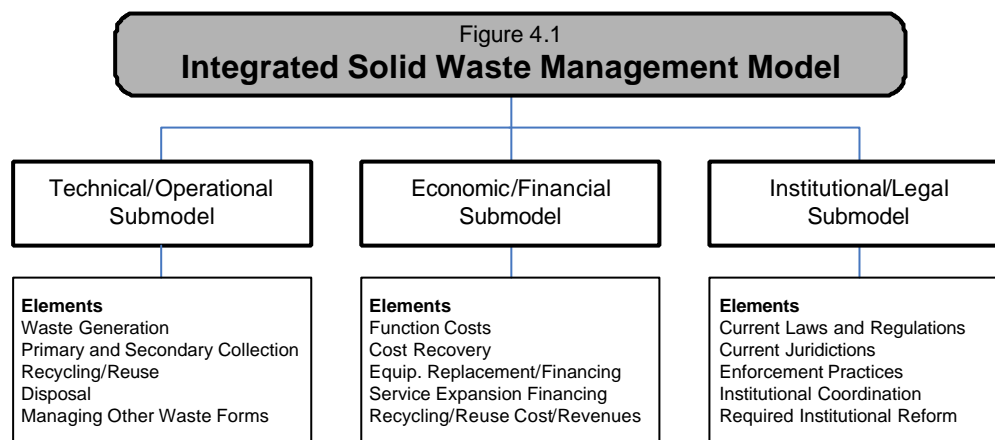
**Institutional Solid Waste** – Solid waste is generated at a number of facilities including various health care facilities in Manado. For the most part, non-infectious waste derived from the health care facilities is transported to the TPA directly by the health care facility staff or placed into nearby TPS. Infectious waste is often burned at the generator's site. One health care facility in Manado has installed a new incinerator. However, this unit has not been put into service because of its cost of operation. Infectious waste from this facility continues to be burned on site. For the most part, all waste generated at small health care facilities such as doctors offices and small clinics are handled within the municipal solid waste collection program. Solid waste such as those that originate from Sam Ratalangi University are collected by the University and transported by Kecamatan Malalayang to the TPA.

## Section 4

# Current SWM Practices in Manado

### 4.1 Context for Evaluating Solid Waste Management in Manado

The success of SWM practices in any city is influenced by a number of factors that must be addressed and optimized if effective and sustainable SWM is to be realized. These factors can be categorized into three main groups as shown in Figure 4.1. This grouping forms the basis for the integrated performance models that must be enhanced or developed to realize effective solid waste management in Manado.



This project has attempted to evaluate the factors shown in Figure 4.1 as they apply to current SWM practices in Manado and to develop appropriate strategies for developing a reasonable and sustainable level of enhanced SWM service. The above factors and model categories form the basis for the deficiency analysis and improvement recommendations presented later in this report.

### 4.2 Current Technical/Operational Practices

Effective integrated solid waste management goes beyond the collection program. For a total integrated program to be successful, it should include an effective means of reducing the amount of solid waste requiring final disposal. This is normally accomplished through source reduction, recycling, composting or incineration practices. Finally, after collection, the remaining solid waste must be disposed of in an environmentally sound manner with minimal health and social consequences. A summary of sustainable practices for the various SWM elements is presented in Appendix E. The following is a general description of the status of the major SWM processes in Manado.

**Collection** – Manado’s municipal solid waste is collected in a number of ways. The technical configurations currently in use are illustrated in Figure 4.2. The primary collection process through which solid waste is transferred from generators to consolidation points (TPS such as those shown in Pictures 4.1 and 4.2 on page 21) or containers such as those shown in Pictures 4.3 and 4.4 on page 21) is managed individually by generators or by cart pushers hired by the *kelurahans* or directly by residential generators. In Configuration #1 (in Figure 4.2), solid waste is collected door to door using carts and transported to either a TPS or container location.

In Configuration #2, waste generators directly carry their solid waste to a nearby TPS or container location. In Configuration #3 (which is prevalent in the rural areas of the city that

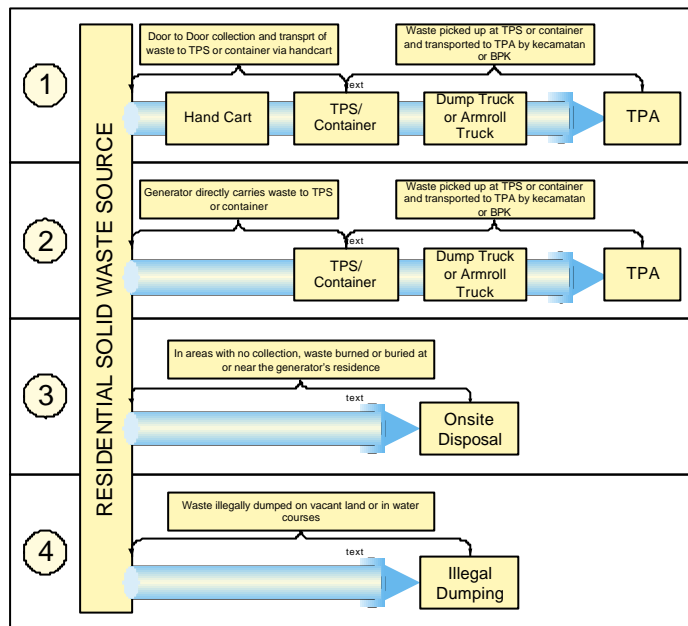


Figure 4.2 – Residential Solid Waste Collection Alternatives

attempt to collect the solid waste at these random locations as well as at the formal TPS locations. This significantly increases the number of stops that the truck must make in collecting solid waste on their designated routes. It also makes it more difficult to keep these informal dumping locations clean.

Solid waste brought to the fixed TPS locations is picked up by open body trucks and personnel working under the jurisdiction of each kecamatan. Examples of these are shown in Pictures 4.5 and 4.6 on Page 22. As used in this report, this is the **secondary** collection program. The solid waste is then transported to the disposal site. In some locations within the City, containers have been deployed by BPK. Solid waste placed into these containers is transported to the TPA on a regular basis by BPK staff using their own arm roll trucks.

The equipment and personnel currently being used for daily collection of residential solid waste is shown in Tables 4.1 and 4.2. The equipment shown under the jurisdiction of each kecamatan is that which was provided by the BPK at the time that the city's solid waste collection function was decentralized. The BPK direct SWM function is based on their utilization of containers placed in various locations around the city and a fleet of four arm roll trucks that is used to pick up and transport containers to the disposal area. A Chinese Association (Tionghoa) utilizes two dump trucks to pickup solid

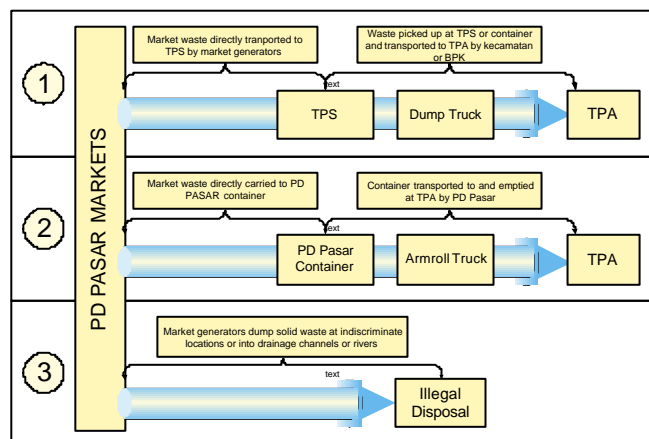


Figure 4.3 – Market Solid Waste Collection Technical Configurations

waste from various kecamatan around the city. One of these trucks is shown in Picture 4.7 on Page 22.

The carts shown in Table 4.1 are used for door to door collection in various kelurahan within each kecamatan. An example of one of these carts is shown in Picture 4.8 on page 22. Based on our observations, it appears that many of these carts are in poor condition and in some cases become immobile and become a stationary collection point when they are no longer operable. The number of TPS in each kecamatan is also shown in Table 4.1. In addition to the number shown, there are a number of former TPS locations that appear to have been abandoned throughout the city. Abandonment has included the removal of the concrete walls which were originally part of the TPS structure. In many cases, however, this removal of the structure has not necessarily resulted in the elimination of waste placement in those locations.

Kecamatan	Equipment (Unit)						
	Dump Truck	Wood Truck	Iron Truck	Arm Roll Truck	Carts	Container	TPS
Malalayang		2	1		24	2	9
Singkil	1					2	28
Wanea	2	1			27	2	44
Wenang	1	3			20	8	14
Sario	1	2			54	2	18
Tuminting		1	1		10		15
Mapanget		1			27	1	28
Tikala	2	1			24	1	35
Bunaken		1			14		1
BP Kebersihan	1			4		21	
Tionghua	2						
<b>Total</b>	<b>10</b>	<b>12</b>	<b>2</b>	<b>4</b>	<b>200</b>	<b>39</b>	<b>192</b>

**Composting and Recycling** – There are no formal composting programs and very little formal recycling practiced in Manado. Most of the recycling is accomplished informally by collection system or disposal area scavengers who separate materials that they then sell to brokers. Illustrations of scavengers operating at the TPA are shown in Pictures 4.9, 4.10 and 4.11. Scavengers in the collection system sort through solid waste placed into the TPS to recover materials that they can sell. In addition, collection crews also segregate materials as they perform their collection tasks. These segregated materials are then sold and the money

derived shared by the collection crew.

Kecamatan	Staffing				
	Driver	Crew	Sweeper	Carts Pusher	Others
Malalayang	3	21	8	24	
Singkil	2	10	3	-	
Wanea	3	16	17	20	
Wenang	6	36	52	4	
Sario	3	20	18	-	
Tuminting	2	12	3	10	
Mapanget	1	10	7	27	
Tikala	3	16	12	24	
Bunaken	1	6	2	-	
BP Kebersihan	3	20	10		81
Tionghua	2	10			
<b>Total</b>	<b>29</b>	<b>177</b>	<b>132</b>	<b>109</b>	<b>81</b>

There are a number of brokers in Manado that buy recovered plastic, corrugated cardboard (such as that shown in Picture 4.12) and metal from the above informal collectors. A profile of the principal recycled material brokers that currently exist in Manado is presented in Annex D.

**Disposal** – Collected solid waste is transported to one of two disposal areas (TPA) in Manado. The locations of these TPA are shown in Figure 3.2. The Sumompo TPA has served as the principal disposal area for the city since 1971. In 2002, another disposal area was developed and opened in Kecamatan Wanea (TPA Taas). However, this site is currently not in use because of access difficulties. The World Bank has also provided support for the



Picture 4.1  
Typical TPS Structure



Picture 4.2  
TPS in Commercial Area





Picture 4.5  
Typical Solid Waste Collection Vehicle



Picture 4.6  
Waste Collection Crew and Vehicle in Commercial Area



Picture 4.7  
Tionghua Association Collection Vehicle



Picture 4.8  
Typical Primary Collection Cart



Picture 4.10  
Scavengers at Work at TPA Sumompo



Picture 4.9  
Scavengers at Collection Vehicle  
at TPA Sumompo

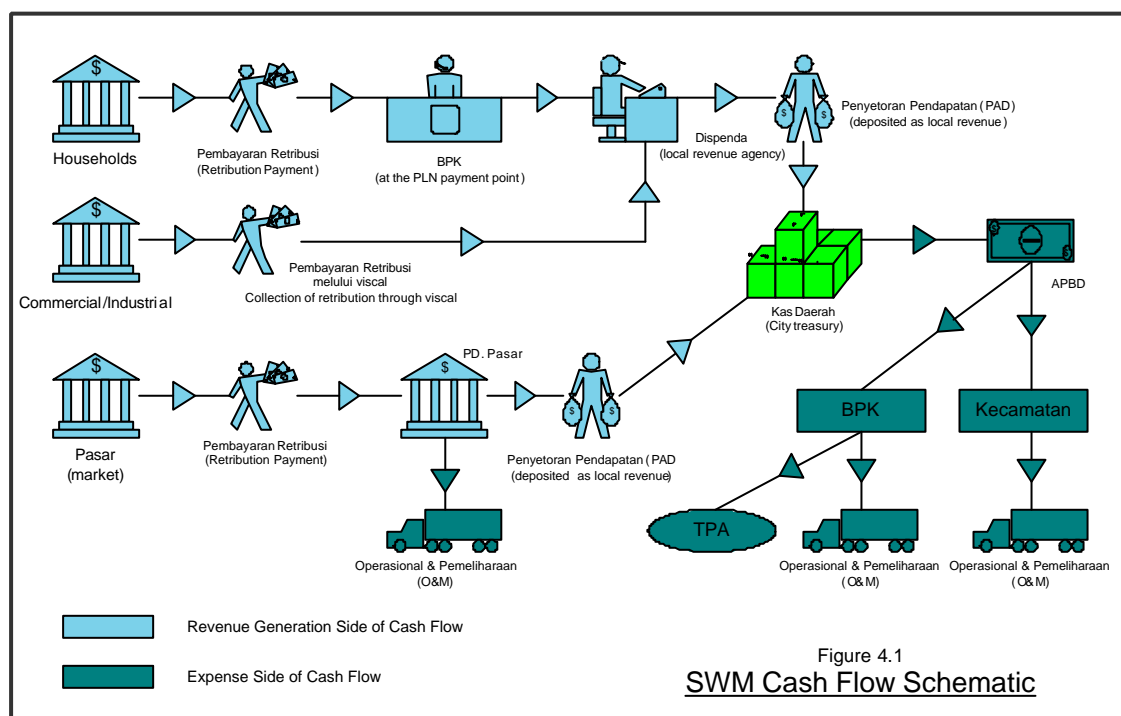


development of a new disposal area (TPA Tingkulu) also in Kecamatan Wanea near TPA Taas. However, construction at this site was never completed because of controversy and public outcry associated with the proposed location.

### 4.3 Economic/Financial Practices

Local regulations that govern SWM in Manado provide a definition of user fees that must be paid for SWM services. User fees charged for SWM services are based on the type of housing or enterprise (office, etc.) from which the solid waste is generated. For example, residents who live in temporary houses (i.e. bamboo or other non-permanent materials) must pay 1,500 Rupiah (Rp) per month while those who live in permanent houses (defined as all masonry or concrete) pay between 3,000 and 6,000 Rp per month depending on their location within the city. For office areas, between 7,500 Rp and 20,000 Rp per month is charged for offices of less than 75 square meters to multi-story offices over 75 m<sup>2</sup>. Many of the larger businesses, who bring their solid waste to the TPA with their own trucks, do so without paying a formal fee. The current fee schedule for solid waste services is shown in Table 4.3 on the following page. Table 4.3 also shows the actual total amounts collected in each fee schedule category in 2002. The general manner in which funds (revenues and expenditures) associated with solid waste management flow is shown in Figure 4.1.

Collection of residential solid waste fees was previously accomplished through the PDAM (local water supply company) billing. However, only a small portion of the population Manado use piped water and this resulted in very low solid waste service revenues. Because



of this, collection of this payment was shifted to incorporation onto the electrical bill on June 1, 2001. However, many people have refused to pay on the basis that pick-up of solid waste is not reaching their neighborhood and that they are, therefore, being asked to pay for a service that they do not receive. Commercial and industrial solid waste fees are collected directly from the generators. Entities that use the PD Pasar markets pay a fee to that organization which is used to pay for market infrastructure operations and maintenance which includes solid waste management. Collected funds flow to the local revenue agency

**Table 4.3**  
**RETRIBUTION TARIFF CLASSIFICATION**

No.	Retribution Category	Monthly Tariff (Rp)	No.	Retribution Category	Monthly Tariff (Rp)
<b>I</b>	<b>Household</b>		<b>VIII</b>	<b>Movie Theatre</b>	
1	Basic	1,500	1	Temporary	10,000
2	Semi "permanent"	2,500	2	D class	15,000
3	"Permanent"	4,000	3	C class	20,000
4	"Permanen" with more than 1 floor blds.	6,000	4	B class	25,000
			5	A class	30,000
<b>II</b>	<b>Boarding House</b>		<b>IX</b>	<b>Office</b>	
1	Accommodate up to 10 people	7,500	1	Semi permanent, permanent buildings up to 75 m2	
2	from 11 up to 25 people	12,500	2	75 m2 and more	10,000
3	from 26 up to 50 people	17,500	3	Buldings with more than 1 floor up to 75 m2	15,000
4	50 people or more	25,000	4	Buldings with more than 1 floor with area 75 m2 and more	20,000
<b>III</b>	<b>Accommodation</b>		<b>X</b>	<b>Stores/ shops</b>	
1	Inn, hostel, and the like	25,000	1	Area up to 25 m2	15,000
2	Cottage	30,000	2	Area from 26 up to 50 m2	17,500
3	Hotel "Melati" (category between inn & 1 star hotel)	35,000	3	Area 50 m2 and more	20,000
4	1 star Hotel	75,000			
5	2 star Hotel	100,000	<b>XI</b>	<b>Beauty Saloon</b>	
6	3 star Hotel	150,000	1	Beauty saloon with 3 employees	5,000
7	4 star Hotel	200,000	2	Beauty saloon with 4 employees	10,000
8	5 star Hotel	300,000	<b>XII</b>	<b>Workshop</b>	
<b>IV</b>	<b>Restaurant</b>		1	Electronic	5,000
1	Not permanent (street food stall)	3,000	2	Small	20,000
2	C 2 class	15,000	3	Big	30,000
3	C 1 class	20,000	<b>XIII</b>	<b>Factory</b>	
4	B class	25,000	1	Big	150,000
5	A class	50,000	2	Medium	125,000
			3	Small	100,000
<b>V</b>	<b>Hospital</b>		<b>XIV</b>	<b>Open space</b>	
1	Birthing hospital (government owned)	7,500	1	Open space	1,500
2	Birthing hospital (privately owned)	7,500	<b>XV</b>	<b>Stall not selling food</b>	
3	Small General Hospital (privately owned)	7,500	1	Medium	5,000
4	Medium General Hospital (privately owned)	10,000	2	Small	2,000
5	Big General Hospital (privately owned)	30,000	<b>XVI</b>	<b>Permanent use of space in market</b>	7,000
6	General Hospital (government owned)	25,000	<b>XVII</b>	<b>Use of space in market</b>	
7	Clinic	3,000	1	With shelter (roofed) (Rp/day)	300
8	Medical service at Doctor's Premise	10,000	2	Open (Rp/day)	200
9	Pharmacy, Drug stores	20,000	<b>XVIII</b>	<b>Other (general) waste</b>	
<b>VI</b>	<b>Kiosk</b>		up to 1 m3	15,000	
1	Kiosk (small)	5,000			
<b>VII</b>	<b>Storehouse</b>				
1	Furniture, textile, food/drinks materials, building materials	50,000			
2	Export, import goods	50,000			
3	Automotive & medicals	50,000			
4	Wood processing	50,000			

**COST RECOVERY FOR KOTA MANADO SOLID WASTE 2002**

	BPK	Wenang	Wanea	Sario	Tikala
RETRIBUTION COLLECTED BY OFFICE OF REVENUE					
RETRIBUTION COLLECTED BY BPK	58,639,794				
RETRIBUTION COLLECTED BY KECAMATAN		47,615,200	16,925,500	19,681,500	15,050,000
TOTAL	58,639,794	47,615,200	16,925,500	19,681,500	15,050,000
OPERATIONAL AND MAINTENANCE COST	1,600,873,300	630,393,000	175,000,000	286,199,000	175,000,000
COST RECOVERY SHORTFALL (In Rp)	-1,542,233,506	-582,777,800	-158,074,500	-266,517,500	-159,950,000
COST RECOVERY SHORTFALL (In %)	-96%	-92%	-90%	-93%	-91%
RECOVERED COST (%)	4%	8%	10%	7%	9%

	Tuminting	Bunaken	Malalayang	Mapanget	Singkil	Total
RETRIBUTION COLLECTED BY OFFICE OF REVENUE						805,611,000
RETRIBUTION COLLECTED BY BPK						58,639,794
RETRIBUTION COLLECTED BY KECAMATAN	28,462,000	4,225,000	16,057,000	19,952,500	18,948,500	186,917,200
TOTAL	28,462,000	4,225,000	16,057,000	19,952,500	18,948,500	1,051,167,994
OPERATIONAL AND MAINTENANCE COST	160,000,000	85,725,000	124,725,000	85,375,000	97,725,000	3,421,015,300
COST RECOVERY SHORTFALL (In Rp)	-131,538,000	-81,500,000	-108,668,000	-65,422,500	-78,776,500	-2,369,847,306
COST RECOVERY SHORTFALL (In %)	-82%	-95%	-87%	-77%	-81%	-69%
RECOVERED COST (%)	18%	5%	13%	23%	19%	31%

Tab 4.3 b

**Total Amounts Collected in Each Fee Schedule Category in 2002**

No.	Descriptions	Category of retributions										
		2,500	3,000	4,000	5,000	6,000	7,000	7,500	10,000	12,500	15,000	17,500
1	Fiscal (Office of Revenue) unit	8,446	10	13,400	1,779	6,005	48	7,883	1,560	122	3,721	117
	Sub-total (Rp.)	21,115,000	30,000	53,600,000	8,895,000	36,030,000	336,000	59,122,500	15,600,000	1,525,000	55,815,000	2,047,500
2	BPK (Rp.)	58,639,794										
3	Kecamatan Wenang (unit)	5,998	3,566	2,737		1,364		372				
	Sub-total (Rp.)	14,995,000	10,698,000	10,948,000		8,184,000		2,790,000				
4	Kecamatan Wanea (unit)	3,144	1,429	721		257		47				
	Sub-total (Rp.)	7,860,000	4,287,000	2,884,000		1,542,000		352,500				
5	Kecamatan Sario (unit)	2,310	1,888	1,212		477		71				
	Sub-total (Rp.)	5,775,000	5,664,000	4,848,000		2,862,000		532,500				
6	Kecamatan Tikala (unit)	1,995	642	1,478		322		39				
	Sub-total (Rp.)	4,987,500	1,926,000	5,912,000		1,932,000		292,500				
7	Kecamatan Tuminting (unit)	3,675	3,189	1,669		479		21				
	Sub-total (Rp.)	9,187,500	9,567,000	6,676,000		2,874,000		157,500				
8	Kecamatan Bunaken (unit)	967	433	90		16		7				
	Sub-total (Rp.)	2,417,500	1,299,000	360,000		96,000		52,500				
9	Kecamatan Malalayang (unit)	2,398	1,211	1,197		256		14				
	Sub-total (Rp.)	5,995,000	3,633,000	4,788,000		1,536,000		105,000				
10	Kecamatan Mapanget (unit)	2,465	1,590	998		698		112				
	Sub-total (Rp.)	6,162,500	4,770,000	3,992,000		4,188,000		840,000				
11	Kecamatan Singkil (unit)	2,006	1,647	1,203		598		79				
	Sub-total (Rp.)	5,015,000	4,941,000	4,812,000		3,588,000		592,500				
	Grand-total unit	24,958	15,595	11,305	-	4,467	-	762				
	Grand-total (Rp.)	142,149,794	46,815,000	98,820,000	8,895,000	62,832,000	336,000	64,837,500	15,600,000	1,525,000	55,815,000	2,047,500

No.	Descriptions	Category of retributions										Totals
		20,000	25,000	30,000	35,000	40,000	50,000	75,000	100,000	125,000	150,000	
1	Fiscal (Office of Revenue) unit	12,218	239	1,005	1,760	24	3,332	30	210	48	84	
	Sub-total (Rp.)	244,360,000	5,975,000	30,150,000	61,600,000	960,000	166,600,000	2,250,000	21,000,000	6,000,000	12,600,000	805,611,000
2	BPK (Rp.)											58,639,794
3	Kecamatan Wenang (unit)											
	Sub-total (Rp.)											47,615,000
4	Kecamatan Wanea (unit)											
	Sub-total (Rp.)											16,925,500
5	Kecamatan Sario (unit)											
	Sub-total (Rp.)											19,681,500
6	Kecamatan Tikala (unit)											
	Sub-total (Rp.)											15,050,000
7	Kecamatan Tuminting (unit)											
	Sub-total (Rp.)											28,462,000
8	Kecamatan Bunaken (unit)											
	Sub-total (Rp.)											4,225,000
9	Kecamatan Malalayang (unit)											
	Sub-total (Rp.)											16,057,000
10	Kecamatan Mapanget (unit)											
	Sub-total (Rp.)											19,952,500
11	Kecamatan Singkil (unit)											
	Sub-total (Rp.)											18,948,500
	<b>Grand-total unit</b>											
	<b>Grand-total (Rp.)</b>	<b>244,360,000</b>	<b>5,975,000</b>	<b>30,150,000</b>	<b>61,600,000</b>	<b>960,000</b>	<b>166,600,000</b>	<b>2,250,000</b>	<b>21,000,000</b>	<b>6,000,000</b>	<b>12,600,000</b>	<b>1,051,167,794</b>

Tabel 4.3c

## BIAYA OPERASI DAN PEMELIHARAAN BPK DAN 9 KECAMATAN 2003

		Badan Pengelola Kebersihan	1. Wenang	2. Wanea	3. Sario	4.Tikala	5.Tuminting	6. Bunaken	7. Malalayang	8. Mapanget	9. Singkil	Total	
		BIAYA OPERASI DAN PEMELIHARAAN	1,597,873,300	630,393,000	174,820,000	286,199,000	175,000,000	160,000,000	85,725,000	124,725,000	85,375,000	97,725,000	3,417,835,300
I	Biaya Operasi (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9+10)		1,090,373,300	606,983,000	155,579,000	269,180,500	148,218,500	143,494,000	79,789,200	106,687,400	59,015,000	94,077,600	2,753,397,500
1	Administrasi Projek		0	4,302,000	13,125,000	3,170,000	13,400,000	8,525,000	4,675,000	3,150,000	3,150,000	5,250,000	58,747,000
2	Gaji dan tunjangan		500,508,800	0	0	0	0	0	0	0	0	0	500,508,800
3	Tunjangan beras		25,000,500	0	0	0	0	0	0	0	0	0	25,000,500
4	Upah buruh petugas lapangan		380,000,000	532,509,400	112,104,000	227,521,000	97,596,000	93,184,000	62,391,200	83,603,900	55,865,000	66,417,600	1,711,192,100
5	Upah perangsang/insentif		10,000,000	0	0	0	0	0	0	0	0	0	10,000,000
6	Biaya kesejahteraan pegawai		57,564,000	0	0	0	0	0	0	0	0	0	57,564,000
7	Jaminan sosial tenaga kerja		30,000,000	0	0	0	0	0	0	0	0	0	30,000,000
8	Pakaian kerja		25,000,000	0	0	0	0	6,240,000	0	0	0	0	31,240,000
9	Biaya operasi lainnya		50,000,000	0	0	0	0	0	0	0	0	0	50,000,000
10	Ongkos kantor :(a+b+c+d+e+f)		12,300,000	0	0	0	0	0	0	0	0	0	12,300,000
	a	ATK	2,000,000	1,033,600	2,500,000	1,900,000	2,902,500	1,650,000	1,200,000	1,200,000	1,200,000	1,200,000	14,786,100
	b	Barang cetakan habis dipakai	3,000,000	0	0	0	0	0	0	0	0	0	0
	c	Jasa perkantoran	500,000	0	0	0	0	0	0	0	0	0	0
	d	Langganan listrik	4,800,000	0	0	0	0	0	0	0	0	0	0
	e	Alat-alat listrik	1,000,000	0	0	0	0	0	0	0	0	0	0
	f	Ongkos kantor lainnya	1,000,000	0	4,000,000	0	12,000,000	3,000,000	0	0	1,100,000	0	20,100,000
II	Biaya Pemeliharaan (1 + 2 + 3)		507,500,000	23,410,000	19,241,000	17,018,500	26,781,500	16,506,000	5,935,800	18,037,600	9,489,500	3,647,400	647,567,300
1.	Biaya Pemeliharaan Gedung Kantor (a + b)		1,500,000	0	0	0	0	0	0	0	0	0	1,500,000
	a	Biaya pengecatan dan pengapuran	1,000,000	0	0	0	0	0	0	0	0	0	0
	b	Biaya pemeliharaan lainnya	500,000	0	0	0	0	0	0	0	0	0	0
2.	Biaya Pemeliharaan Kendaraan		505,000,000	0	0	0	0	0	0	0	0	0	505,000,000
	a	Biaya pengujian kendaraan	15,000,000	0	0	0	0	0	0	0	0	0	0
	b	Reparasi dan penggantian suku cadang	50,000,000	0	0	0	0	0	0	0	0	0	0
	c	BBM dan pelumas	150,000,000	69,138,000	23,850,000	36,589,500	22,320,000	30,895,000	11,523,000	18,733,500	14,570,500	21,210,000	248,829,500
	d	Pembelian akku dan ban mobil	25,000,000	0	0	0	0	0	0	0	0	0	0
	e	Pemeliharaan alat berat/sewa bulldozer	200,000,000	0	0	0	0	0	0	0	0	0	0
	f	Pemeliharaan kendaraan lainnya	65,000,000	0	0	0	0	0	0	0	0	0	0
3.	Biaya Pemeliharaan Inventaris (a + b)		1,000,000	0	0	0	0	0	0	0	0	0	1,000,000
	a	Reparasi dan service mesin kantor	500,000	0	0	0	0	0	0	0	0	0	0
	b	Pemeliharaan inventaris lainnya	500,000	0	0	0	0	0	0	0	0	0	0
III	Pembelian Inventaris Kantor		3,000,000	2,275,000	0	0	0	0	4,275,000	275,000	4,625,000	2,275,000	16,725,000
TOTAL PENGELUARAN (I + II + III)			1,600,873,300	632,668,000	174,820,000	286,199,000	175,000,000	160,000,000	90,000,000	125,000,000	90,000,000	100,000,000	3,434,560,300

(Dispenda). Based on city records, Rp 1,051,167,994 was collected in 2002 through Retribusi fee collection. This is far below the actual cost of the services provided by the City and each kecamatan which are shown in Table 4.4.

Costs for the BPK and kecamatan solid waste management activities is funded through a city budget process where funds are provided based on budget proposals made by the individual agencies. Actual solid waste management costs borne by the kecamatan and BPK

**Table 4.4**  
**Cost Revenue Summary - 2002**

	Collected through (Rp.)	Retribution collected (Rp.)	O & M	Differences (Rp.)
1	Fiscal (Office of Revenue)	805,611,000	0	805,611,000
2	BPK	58,639,794	1,600,873,300	-1,542,233,506
3	Kecamatan Wenang	47,615,200	300,000,000	-252,384,800
4	Kecamatan Wanea	16,925,500	175,000,000	-158,074,500
5	Kecamatan Sario	19,681,500	175,000,000	-155,318,500
6	Kecamatan Tikala	15,050,000	175,000,000	-159,950,000
7	Kecamatan Tuminting	28,462,000	160,000,000	-131,538,000
8	Kecamatan Bunaken	4,225,000	90,000,000	-85,775,000
9	Kecamatan Malalayang	16,057,000	125,000,000	-108,943,000
10	Kecamatan Mapanget	19,952,500	90,000,000	-70,047,500
11	Kecamatan Singkil	18,948,500	100,000,000	-81,051,500
	<b>Total</b>	1,051,167,994	2,990,873,300	(1,939,705,306)

in 2002 are presented in Table 4.4. As shown, there is a considerable difference between costs and the extent of direct fees collected. This leads to a situation where cost must be covered by budgets derived from general municipal revenue sources. As is the case with any municipality, budgets established for solid waste management must compete with other public service needs including education, roads, etc. The budgets that have been established in the case of both

the BPK and kecamatans have been consistently low to a point where supplemental budgets have been commonly required to fund a full year of SWM activities at all administrative levels.

Direct revenues collected by each Kecamatan are considerably below the actual costs for operating and maintaining their solid waste collection programs. Direct costs for the Kecamatan programs are shown in the Kecamatan profiles in the Annex of this report.

Cost recovery within the Kecamatan range from 5% (Bunaken) to 23% (Mapanget). When considered with all of the revenue also collected directly by BPK and the Office of Revenue, the City's overall cost recovery rate is about 31%.

#### 4.4 Legal/Institutional Practices

There are a number of existing mayoral decrees, laws and regulations that affect solid waste management in Manado. A number of these are shown in Table 4.5 on the following page. While existing legislation may provide the basis by which reasonable SWM can be achieved, there is little enforcement of key provisions. For example, with a focus on preventing solid waste from getting to drainage channels, rivers and Manado Bay, the lack of enforcement of laws pertaining to litter or illegal dumping is crucial.

In the last two years there has been a significant change in the roles and responsibilities of key participants in SWM in Manado. This includes the decentralization of many of the solid waste collection functions from the BPK to the kecamatan level of governance. A decree of the Mayor (Decree #12 in 2000) established decentralized solid waste management with the main roles transferred to the districts (kecamatan), sub-districts (kelurahan), and community based organizations (CBO). This policy change reduced responsibilities of the city's solid waste department. Presently, the BPK only directly manages solid waste generated at the city center (primarily in Kecamatans Wenang and Sario), the final disposal area and collection of solid waste from riverbanks and shoreline areas.

Through another decree of the Mayor (Decree #48, 2001) the BPK's organizational structure was altered and BPK is now tasked with a number of ongoing responsibilities including:

- **Implementation** of new policies and development
- **Planning** of new solid waste management infrastructure
- **Administration** in general of department personnel, equipment, and financial matters
- **Coordination** between all major participants in the City solid waste management program
- **Monitoring** of performance of the solid waste management system to assure its compliance with a reasonable standard.

These tasks and responsibilities are crucial if a reasonable and consistent level of service is to be maintained throughout the City and in each kecamatan. While the above responsibilities have been placed on BPK, there is some concern that they have not been effectively performed since decentralization of the secondary collection process. Enhanced application of these responsibilities will be necessary if SWM improvement and an effective sustainable level of service are to be realized.



**Table 4.5**  
**Decrees, Decisions of the Mayor and Laws pertaining to Solid Waste Management in Manado**

Decree, Laws and Regulations	When Issued	Pertaining to	Description
SK Walikota # 133	1997	Discussion Committee for Improved Cleanliness	
Perda #6	April 1999	Management & Retribution of Solid Waste * replacing Perda No. 7/Perda/WKDM, 1978	Structure & amount of tariff
SK Walikota #136	October 2000	Decentralized SWM Participation of Staff of Kelurahan & LKMD or LPM in Manado	Duties & responsibilities of related parties in solid waste management
Perda #12	December 2000	Formation of Organization of Dinas in Manado	Organization structure, main duties, functions
Perda #13	December 2000	Formation of Organization of "Technical" Agencies/ Offices in Manado	Organization structure, main duties, functions
Perda #14	December 2000	Formation of Organization of PDAM & PD Pasar Manado	Organization structure, main duties, functions Transition from Dinas to PD Pasar in December 2001
Perda #15	December 2000	Formation of Organization of Kecamatan in Manado	Organization structure, main duties, functions
Perda #16	December 2000	Formation of Organization of Kelurahan in Manado	Organization structure, main duties, functions
Kep. Walikota #48	March 2001	Organization structure, duties, function of BPK	Redefined general responsibilities of the City's solid waste agency
Kep. Walikota #12	January 2002	Technical Guidance of Execution of Decentralized Solid Waste Management with Participation of Staff of Kecamatan, Kelurahan and LPM/other institutions in Manado	incl. determination of collection fee for kelurahan and kecamatan
Kep. Walikota #27	February 2002	Formation of Monitoring Team of Responsibilities of Solid Waste Management in Kecamatan & Kelurahan in Manado	"Asisten" as Coordinator of 3 kecamatan Heads of Dinas, Kantor, Badan, responsible for 2-4 kelurahan
Kep. Walikota #28	February 2002	Determination of Target of Retribution/ fee of Solid Waste Mgt. in each Kelurahan in Manado FY 2002	Monthly & annual target for each kelurahan & kecamatan
SK Walikota #49	2002	Technical Guidance	determination of retribution/ fee
Kep. Walikota #16	January 2003	Execution of Solid Waste Management & Use of Equipment in Manado	Duties, responsibilities of community, BPK, and others
Kep. Walikota #17	January 2003	Execution of collection of Retribution & Fee * replacing Kep Walikota 12, 28, and 49	
Kep. Walikota #22a	2003	Guidance of Service, infrastructure, solid waste equipment/ fleet & development of waste free areas in Manado	Duties, responsibilities of BPK, kecamatan, kelurahan
Kep. Walikota #29	2003	Coordination of execution & assessment of "Bangun Praja Lingkungan Berhikmat" program in Manado	Determination of waste free areas
Srt. Walikota 974/46	2003		
Pemb. Walikota	2003		
Srt. Wakil Walikota 974/14	2003		
SK Walikota #74a	2003	Appointment of evaluation team & its secretariate of cleanliness competition/ Supervisor of waste free areas & "Bangun Praja Lingkungan Berhikmat" in Manado	
SPT Kadan BPK 974/63	2003	Appointment of personnel in BPK & its contract employees to collect solid waste Retribution at PLN offices	
Srt. Walikota #660/356	2003		

**Notes:**

SK:	Surat Keputusan	: Letter of Decision
Srt.:	Surat	: Letter
Kep.:	Keputusan	: Decision
Perda:	Peraturan Daerah	: By law/ local regulation
Pemb.:	Pemberitahuan	: Circular
SPT:	Surat Perintah Tugas	: Assignment Letter
Kadan.:	Kepala Badan	: Head of Agency
BPK (or BPK KM):	Badan Pengelola Kebersihan	: Solid Waste Agency
KM:	Kota Manado	
PNS:	Pegawai Negeri Sipil	: Government employee/ servant
THL:	Tenaga Harian Lepas	: (daily) contract worker
LKMD:	Lembaga Ketahanan Masyarakat Desa	: Village Community Resilience Body
LPM:	Lembaga Pemberdayaan Masyarakat (replacing LKMD)	: Community Empowerment Body
PDAM:	Perusahaan Daerah Air Minum	: Water Supply Enterprise
PD Pasar:	Perusahaan Daerah Pasar	: Market legally owned by local government
PLN:	Perusahaan Listrik Negara	: Power company owned by central gov.
Asisten:	"Assistant"; position subordinate to mayor	
Walikota:	Mayor	
Wakil Walikota:	Deputy Mayor	
Bangun Praja-Lingkungan Berhikmat	Cleanliness competition program in Manado (nationwide called Bangun Praja Lingkungan)	

## Section 5

# Solid Waste Collection Deficiency Analysis

The overall perception that the solid waste management program in Manado is below a reasonable standard of performance is a function of the different factors shown in Figure 4.1. Correction of these deficiencies forms the basis for the recommendations presented in Section 7 of this report. Furthermore, the formulation of any strategies must be a function of the specific deficiencies that are to be rectified. The following is an assessment of the deficiencies that exist in the current solid waste collection scheme in Manado.

### 5.1 Technical/Operational Deficiencies

1. **TPS Design and Configuration** - The current design of the fixed TPS throughout the city is an impediment to effective collection. Each of the TPS locations must be manually cleaned every time that solid waste is picked up at those locations. In a time and motion evaluation of one of the collection routes in Kecamatan Sario, each collection stop took approximately 10 to 15 minutes to collect solid waste and to cleanup around the TPS location. The configuration of the TPS necessitates the labor-intensive manual approach currently being used.
2. **Distance to TPS or containers for Residential and Small scale Commercial Generators** – In many cases throughout the City, residential and commercial generators must travel significant distances to bring their waste to a TPS or container collection point. This creates a situation where it becomes more “convenient” for generators to illegally dump their waste along roadways or on vacant land or in drainage courses. This has also evolved because there is no effective enforcement of regulations that hold people accountable for these actions. In the perception of some residential generators, waterways may be viewed as a good way to dispose of their solid waste since the material generally flows downstream away from their residences. The distance to collection points also leads to the random placement or dumping of solid waste along Manado’s roadways. This randomly placed solid waste must be picked up by collection crews and becomes a significant contributor to litter and waste reaching drainage courses and subsequently Manado bay. During a time and motion analysis of one of the collection routes in Kecamatan Sario, it was noted that the number of collection stops far exceeded the number of formal TPS that the kecamatan identified for their district. This is due to the fact that many informal collection points have evolved as a result of the random placement of solid waste along roadways on which the collection vehicle travels. Since collection personnel on this route attempted to pickup the solid waste in many of these random locations, the overall efficiency of the collection program is significantly compromised.
3. **TPS Locations On or Adjoining Drainage Structures** – As shown in Pictures 5.1, 5.2, and 5.3 on page 32, many of the TPS throughout the city are located in close proximity to or directly over drainage structures. While collection crews endeavor to pick up all of the solid waste at the TPS, they do not appear to make a special effort of removing solid waste that might have fallen into the drainage channels or structures. This material may subsequently be washed downstream during heavy rains events thereby contributing to the solid waste loading in Manado's rivers and in the bay.

4. **Collection Equipment and Personnel** - While collection crews appear to be diligent in cleaning up the TPS locations after they have collected the solid waste placed there, they must do so in a labor-intensive manner. This is time consuming work that affects the total number of TPS or collection points that can be serviced in a typical work day. Collection generally involves the placement of the solid waste onto a tarp that would then be used to pick up the material and pull it into the truck. Staff on the ground picks up the tarp and hands it to staff in the vehicle who then pull it into the truck to deposit the solid waste into the vehicle load area. This is shown in Pictures 5.4 and 5.5. This is also the case in commercial and market areas as shown in Pictures 5.6, 5.7 and 5.8.
5. **Collection Routing** - Current collection routing is a function of the location of TPS and other waste collection points within each kecamatan. Specific analysis of truck routing should be undertaken to minimize the amount of time required to achieve collection or to maximize the number of collection that can be serviced in a typical work day. (Ultimately, an analysis of truck routing should follow consideration of the number and location of collection points that are required to effectively serve the various districts in Manado. The location of additional collection points may affect optimum truck routing. In addition, use of a block collection scheme (as will be defined in Section 6) may also affect truck routing.
6. **Inability to Collect Solid Waste in the Densely Populated Areas** - Densely populated areas, particularly near riverbanks, are an important source of the solid waste that finds its way into Manado Bay. The lack of vehicle access to these areas and the distance to TPS collection points makes solid waste collection problematic in these areas. This leads to random dumping particularly into drainage courses. Examples of this are shown in Pictures 5.9, 5.10, 5.11 and 5.12.

## 5.2 Economic/Financial Deficiencies

1. **Level of Service Funding** - The ability to provide an effective level of service is a function of having sufficient money to pay for the costs associated with a reasonable level of service. This includes money to pay for all operating and maintenance costs as well as that required to replace or buy new equipment when necessary. Sustainable solid waste collection requires that all equipment used in the process be properly maintained and not used beyond its normal life expectancy. Older equipment that is more prone to break down can dramatically affect the efficiency of collection.
2. **Budgetary Process** – The current budget process does not appear to have direct linkage between the actual costs of an effective service and the resulting budget allocations made. After defining the required level of service, the resources required to achieve that level must be defined. These should be the basis for approved budgets for SWM at each level of administration. Developing a consistent level of service in each kecamatan will require close coordination and monitoring on the part of BPK of the various activities undertaken by each kecamatan. Greater effort in BPK coordination responsibility can help to establish a consistent level of service that meets a minimum performance standard in each kecamatan.
3. **Revenues and Cost Recovery** - Revenues are collected for solid waste management. However, the revenues derived through the current fee structure are far less than what is required to cover the costs associated with even the current SWM program. This requires additional budget appropriations to cover the cost of the program. In addition, there is no direct link between the revenues collected and the

performance effectiveness of the services provided. The transition of the secondary collection function from the city to the kecamatan has created some confusion and unwillingness on the part of some residential generators to pay for additional primary collection services that would bring their solid waste to the TPS collection points. Their unwillingness to pay for primary collection services may be due to the fact that since they are providing a SWM fee through their electrical bill, they should be provided the primary collection service without additional cost. The inability or unwillingness to acknowledge the difference in and need for both the primary and secondary service is a problem in optimizing the collection program, particularly the primary collection process.

4. **Financial resources for collection program expansion or for new equipment and technology** - Increased efficiency of any collection program is a function of the technology used for temporary storage of solid waste at consolidation points and to collect the waste from those points. There is currently a lack of financial resources to significantly change the manner in which solid waste is collected in Manado. A logical technology change would encompass the elimination of fixed TPS and their replacement with a container-based system. In addition, existing financial constraints do not easily allow the collection system to be expanded to areas that have not been serviced in the past.

### 6.3 Legal/Institutional Deficiencies

1. **Planning** - In decentralizing solid waste collection to the kecamatan level of governance, equipment and personnel were assigned to provide collection under the management of each kecamatan. The responsibility for planning solid waste management infrastructure improvements and expansions remains with the BPK. While the city's strategic plan recognizes the need to improve performance at all levels of solid waste management, it does not address the immediate planning and technical capacity building required to maximize the performance of the existing resources or to implement new technology or approaches at the kecamatan and kelurahan levels.

One key issue that relates to the potential lack of coordination between the kecamatan and the BPK is the repair and maintenance of vehicles provided to each kecamatan for collection. Mechanical equipment of any form requires periodic repair. The frequency and nature of these repairs is a function of the level of preventative maintenance applied to the equipment. The coordination between BPK and the kecamatans has not led to clear definition of responsibilities when it comes to maintenance and repair of collection equipment. An effective level of service will require sufficient equipment for sustainable performance which will include additional stand-by equipment to serve as backup for equipment that breaks down and must be repaired.

2. **Coordination** - Effective solid waste management requires close coordination between all of the people or agencies that must control the solid waste from its point of generation to final disposal. This includes coordination between the manner in which individual residential generators deliver their waste to the collection point (the primary collection process) and the way that those responsible for retrieving solid waste from collection points and transporting it to the disposal area (the secondary collection process) accomplish their delegated responsibilities. This coordination must include the issue of managing and maintaining technical resources provided for SWM as well as the manner in which solid waste control and responsibility is transferred from one program participant to the other as the solid waste moves from the generator to its final disposal.

- 3. Enforcement** - While there are laws and regulations that govern many aspects of solid waste management, their enforcement is generally lacking. This is crucial if the root issue of solid waste reaching Manado bay is to be addressed. So as to maintain the required control of solid waste from generators to disposal, an effective collection system must be in place. However, this must go hand in hand with strict enforcement of litter laws that prevent solid waste generators from indiscriminately dumping their solid waste in illegal locations. While the project team is aware of anecdotal information that indicates that there was stricter enforcement in the past, this does not appear to be the case at present.
- 4. Public Awareness** – Public awareness of the health related and other issues associated with ineffective solid waste management is low. This affects both the actions of residential and commercial generators in managing their solid waste as well as their willingness to pay for improved services.

Picture 5.1  
TPS Over Drainage Structure Along Residential Street



Picture 5.2  
TPS Over Drainage Structure



**Picture 5.5**  
**Secondary Collection Process**



**Picture 5.6**  
**Solid Waste Accumulation at Market Container**



**Picture 5.7**  
**PD Pasar Solid Waste Container at Market**





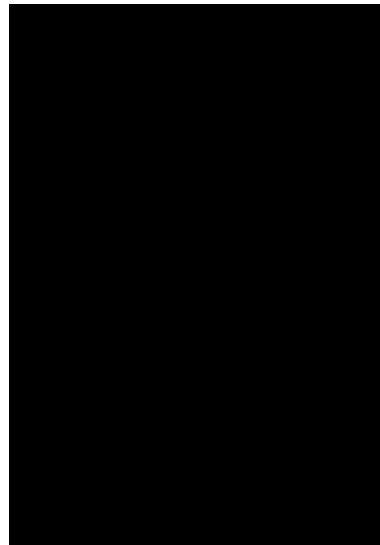
**Picture 5.9**  
**Concentrated Housing Along River**



**Picture 5.10**  
**Solid Waste at Rear of Residence**  
**in Drainage Course**



**Picture 5.11**  
**Informal Disposal Area Near Drainage Structure**





Picture 5.12  
Solid Waste Accumulation Along City Street



Picture 5.14  
Solid Waste Burnt Pit on Bunaken Island



## Section 6

# Target Collection Levels of Service

Improvements in the level of solid waste collection service in Manado should be based on an attempt to achieve a reasonable and sustainable level of service throughout the City. To the degree possible, the means for establishing a common level of effective service in all of the kecamatan is important. The BPK can have an important role (already mandated by the Mayor) in coordinating and assisting in the development of a consistent level of performance in each kecamatan. This target level of performance will be a function of the adequacy of collection resources (equipment and personnel) available for service and the manner in which they are used. The project team believes that the following forms the basis for and defines a reasonable target level of service that can be achieved in Manado's solid waste collection program. Ultimately, it should be the responsibility of the BPK to help each kecamatan maintain the acceptable performance standard.

### 6.1 Service Options

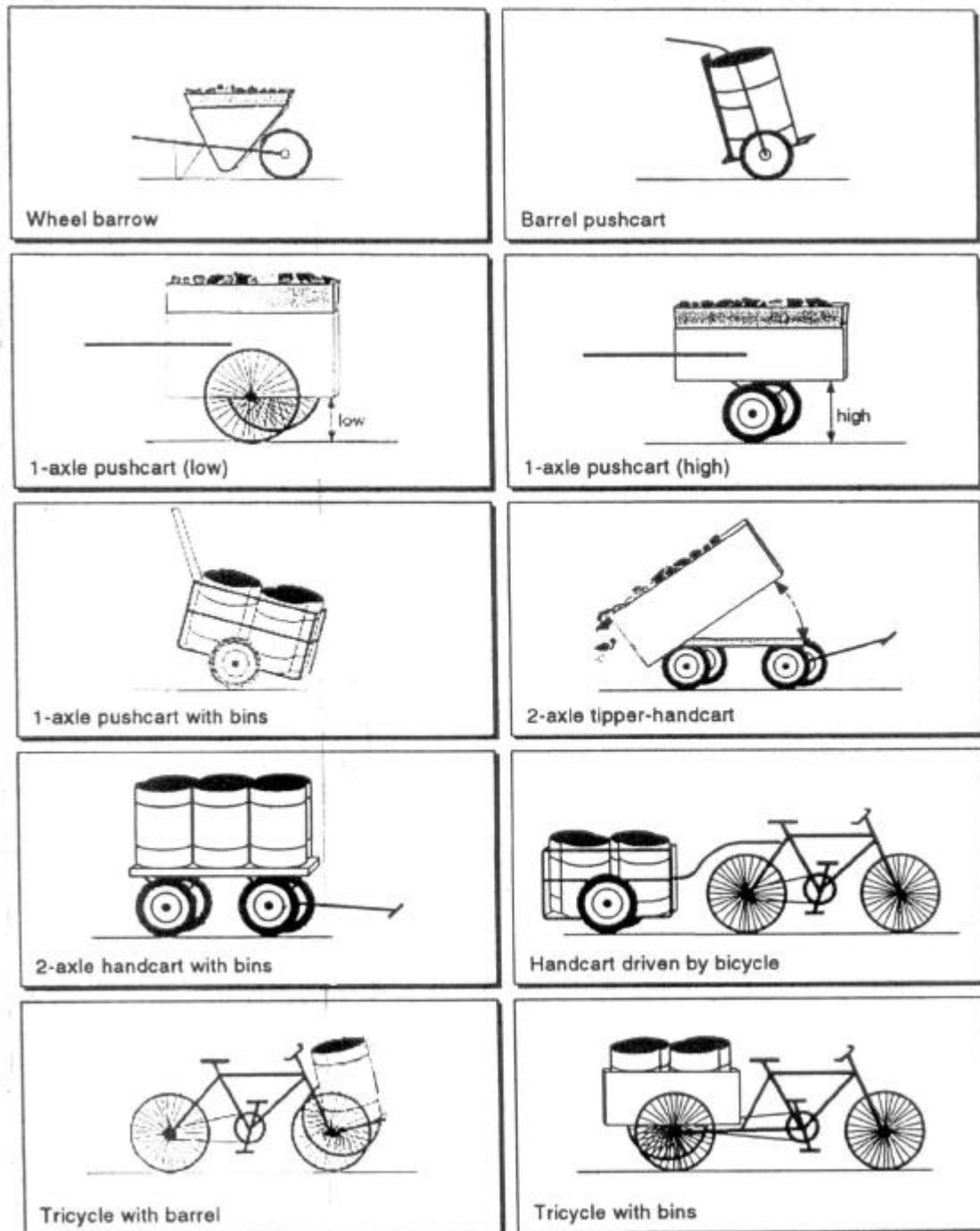
**Primary Collection Equipment Resources** - The use of collection vehicles (manual or mechanized) is an important element that influences the design and efficiency of both the primary and secondary collection processes. Vehicles have to be selected on the basis of a number of factors including: 1) loading capacity, 2) the number of crew required to operate the vehicle, 3) costs of owning and operating the vehicle, 4) operational and maintenance requirements and 5) on the accessibility of the service area to a particular vehicle design.

Handcarts and pushcarts are often used as a low-cost means of collecting solid waste door-to-door in primary collection. Under normal service, manually operated handcarts and pushcarts are limited to about 1 kilometer with an effective speed of about 3 kilometers per hour. They are generally well-suited for the conditions normally found in low income or other areas where narrow streets, low waste generation rates, high waste density, and population density prevail. Use of handcarts and pushcarts may be warranted for primary collection in Manado since they are typically non-polluting, inexpensive to manufacture and operate, simple in design and can usually be manufactured locally. This makes them a very important element of the sustainable low-cost technology collection approach particularly suited for primary collection.

There are a variety of different cart designs that have been used throughout the world and examples are shown in Figure 6.1 on the following page. In selecting a cart design, attention should be paid to designs that allow easy handling since the carts have to be moved by manpower. This limits their loading capacity. An appropriate cart volume should range between 0.5 to 1.5 cubic meters with an upper weight limit of about 500 kg. The ultimate size of handcarts and pushcarts will also be dependent on the specific configuration and characteristics of the areas to be collected. Areas with steeply sloping roadways and difficult travel surfaces will affect cart design and capacity. This is relevant in a number of districts in Manado.

One important aspect of the proper design of a collection cart is the manner in which they are loaded and unloaded. To the degree possible, the need to dump the waste on

Figure 6.1  
Examples of Hndcart and Tricycles



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the ground for transfer to a larger transport vehicle should be avoided. This practice is messy and significantly contributes to litter. It is also tiring work and exposes collection personnel unnecessarily to health risks in handling solid waste materials. (In areas where households use plastic bags for waste storage, this problem is less significant.) One way to overcome the need for dumping the waste on the ground is to use bins, large bags or barrels within the carts that can be lifted out for transferring material to larger vehicles.

**Secondary Collection Equipment Resources** - Motorized vehicles are normally required for secondary collection where greater volumes of solid waste must be managed. This is especially the case when solid waste must be transported long distances to remote disposal areas. However, in many cities throughout Indonesia, mechanized vehicles are limited to larger roadways where they are able to traverse easily. They cannot be effectively used in some narrow neighborhood roadways. While many sophisticated vehicles have been developed in industrialized countries for solid waste collection, these may not be appropriate for the collection schemes that may be required in Manado because of their cost, complexity and the characteristics of Manado's roadways. Examples of typical mechanized equipment used in solid waste management are shown in Figure 6.2 on the following page.

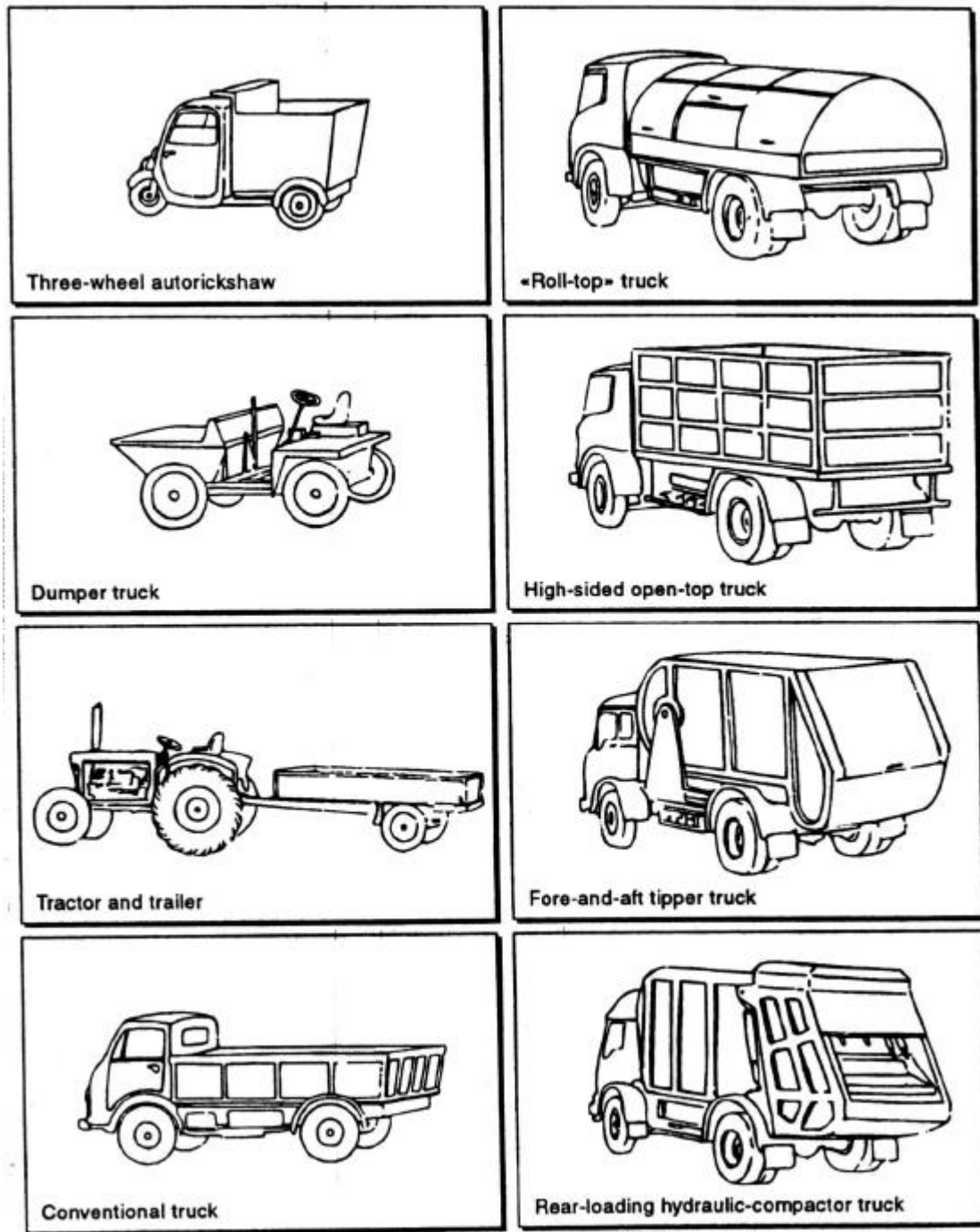
Additionally, there is considerable advantage in selecting a vehicle type that is manufactured locally or already in use for other general purposes within the city. Attempting to standardize the type of mechanized vehicle used in secondary collection helps to reduce vehicle downtime by making maintenance easier to perform since mechanics are more familiar with the equipment and spare parts may be more readily available. In some cases, agricultural tractors and trailers have proved to be a suitable choice for mechanized vehicle transfer of solid waste. This is especially the case in areas close to the disposal locations.

**Personnel Resources** - The number of personnel required to perform collection services is dependent on the type of vehicle used, the form of interim storage between the primary and secondary collection programs and the operational pattern adopted in either the primary and secondary collection process. Labor-intensive systems are more likely to be used in areas where sophisticated motorized equipment cannot be considered due to high-cost or difficult operational conditions.

One of the key considerations that need to be given in developing a sustainable collection system (especially one that is labor-intensive) is the need to make sure that collectors are properly compensated. In many regions of the world, solid waste collectors have a low social status and are often paid insufficiently to even earn a living for their families. This leads to low morale and significant job turnover where any training provided to collectors is lost as a result of collection personnel leaving for better jobs. Additionally, solid waste collectors will often retrieve recyclable materials as they collect solid waste so as to supplement their earnings. This practice can influence the efficiency of collection by reducing the time that a collection crew actually spends collecting solid waste.

**Collection Frequency** - One of the key decisions that must be made in defining solid waste collection services is the frequency at which the solid waste is collected both at the primary and secondary level. In some instances, decreasing the frequency of collection can provide sufficient savings to allow enhancement or expansion of the collection services. However, this is only practical in areas where solid waste storage does not create aesthetic problems such as odors. In Indonesia, prevailing temperatures

Figure 6.2  
Examples of Motorized Vehicles



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will, more than likely, require frequent collection. As a result, the collection system has to provide the means by which residential solid waste is removed from residences daily. Organic solid waste will start to decompose within one or two days. Beyond that time offensive odors may result. The primary collection system has to provide the means by which solid waste is removed from the residences daily while the secondary system must manage the material at the TPS or containers frequently enough so that odor and vector (flies, etc.) problems do not develop at the collection points. When this latter situation occurs, nearby residents sometime start fires to eliminate resulting odor and vectors. However, this often results in the replacement of an aesthetic problem with a potentially greater health impact due to the migration of smoke from the burning solid waste to nearby residences and businesses.

**Primary and Secondary Collection Interface** - One of the most important aspects of successful waste collection is the physical interface between the primary and secondary collection processes. In Manado, the existing interface configuration is one of the main problems with the current collection program. Insufficient and improperly designed or located TPS collection points have made it difficult to collect solid waste in a controlled and thorough manner. The nature of the interface is determined by the way that primary collection is accomplished. There are three basic schemes used in primary collection including:

1. Communal storage where people bring their refuse directly to a communal collection point or pay somebody to do so,
2. Block collection which utilizes mobile collection points where residents carry their waste at prescribed days, times and places to a passing collection vehicle which stops at a designated location to receive the waste, and
3. Door-to-door collection where the waste is collected by government or private contractor personnel who then bring the collected waste to a TPS or container.

Communal storage where household generators bring their waste to communal storage facilities such as roll-off container or concrete enclosures as is the case in Manado is the cheapest alternative in terms of direct cash requirements. In this case, households contribute in-kind services for primary collection by either providing the effort to carry their solid waste to the collection points or paying somebody else to do it. However, for this approach to be practical, communal storage points have to be sited within a reasonable distance from generators to be acceptable to them. Generally, residential generators will willingly carry their waste between 50 and 100 m to communal storage points. However, greater distances often leads to their seeking “more convenient” alternatives that may include illegal dumping.

In using mobile collection interfaces or block collection, residential generators will still choose to only carry their waste about 50 to 100 meters to a mobile collection point. Such locations may consist of a handcart or motorized vehicle. If the mobile collection point were a handcart, the primary collection process would still include the transportation of the collected waste in the cart to another collection point for transfer to the secondary collection system vehicle.

The most costly, but most reliable, primary collection approach is house to house collection in that it serves every household and does not rely on the willingness of generators to provide the transportation of their waste to the collection point. In many developing countries, door-to-door curbside collection with manually operated vehicles is the most widespread collection method. Household contribution in this approach is minimal in that

they are only responsible to bring their solid waste to curbside or to make it available to the collector at the agreed to collection frequency.

In some cases where accessible roads are adequate, house to house collection with motorized vehicles may be more efficient than manually operated carts. However, the roadways on which the truck travels have to be able to support the traffic disruption that could occur as a result of the truck stopping frequently to collect waste. In many of Manado's roads, this would not be practical since other vehicles would not be able to move past a truck that had stopped to collect solid waste from its generators.

The main advantage of the door-to-door collection with mechanized equipment approach is that the collected waste can be transported directly to the disposal area without any transfer to another conveyance vehicle. This effectively eliminates the interface between primary and secondary collection systems. One of the limitations of this approach is that if certain households are in inaccessible areas along the collection routes, collection personnel will have to travel considerable distances by foot to retrieve solid waste to bring it back to their vehicles if complete collection coverage is to be maintained.

In planning, recognition must be given to the fact that the primary and secondary collection processes are interdependent and, for planning purposes, do not necessarily operate as a single function. Developing a recommended level of service in Manado must recognize this fact since the responsibility for each collection function is now under the jurisdiction of a different level of government.

The interface between the primary and secondary collection process is extremely important in determining the overall effectiveness of the collection program. If the primary collected waste is not picked up regularly at the collection or transfer sites by the secondary collection system, solid waste will accumulate to a point where containers or TPS locations may become full. If waste is not readily collected at stationary collection points, waste accumulations can lead to significant litter or odor that discourages residents and collectors from using the primary collection system. This is also a critical issue if mobile collection points are used since waste collectors will have to lose considerable time waiting for trucks to receive their collected waste or they may opt to dump the collected refuse elsewhere or at the site where the truck will eventually be. As a result, close cooperation between those providing the primary collection service and those that provide secondary collection is critical if the overall collection program is to be successful.

In some circumstances, consideration should be given to the construction of transfer depots that would allow for greater consolidation of solid waste material prior to transport to disposal locations. Since transfer depots may serve more than one kecamatan depending on its location, they should best be developed by the BPK as an enhancement of its container-based collection services. In their coordination of thorough needs assessments for each kecamatan, potential locations for transfer depots may become evident.

**Organization Structure and Management** - A simple organizational structure enabling some basic mechanisms such as cost recovery, supervision and quality control is necessary in the primary collection process. These organizational features must also be part of the secondary collection process as well. The current responsibility for secondary collection lies primarily with the kecamatans with some involvement with the BPK. Responsibility for primary collection is random with some kelurahans, such as Kelurahan Ronatana, actively involved in primary collection. For primary collection to be successful, there are two basic approaches that can be used for primary collection. The current approach of requiring that generators get their waste to TPS or containers may continue. Conversely, the kelurahan or



lingkungan administrators may take a proactive approach is organizing cart-based door to door collection for their jurisdictions. This service could be provided by community-based organizations or by private contractors including micro-enterprises that make use of people already living in the area.

**Micro-enterprise Approach** - Main participants involved in this form of primary collection are waste generators, collectors (possibly organized in the form of a small private enterprise), and a legally responsible municipal authority (which in Manado's case may be the kelurahans working in conjunction with the kecamatan.) In this case, a small-scale enterprise may be a legally constituted cooperative of a number of collectors that may be recruited from within the community where the collection function is to be provided. Initial financial support for the private enterprises may be provided through loans from financial institution or an NGO. The primary collection service in each kelurahan could be contracted out to the small private enterprise based on a written agreement that defines the tasks and responsibilities of both the operator and the government entity. An important benefit of a written agreement is that it provides the basis for establishing performance standards that the kelurahan can hold the collection contractor or enterprise to.

One of the difficulties in using this approach is the current lack of experience that may exist at the kelurahan level and with the potential participants in the small private enterprise in developing a contract that will accomplish the desired purpose. The BPK may provide assistance in this matter by developing a contractual model that might be appropriate in the various districts of the city. In assisting with the establishment of a model written agreement, consistent practices in each kelurahan and thereby throughout the City will be supported. In addition, NGOs might provide training and consulting services for micro-enterprise operators.

## **6.2 Recommended Primary (Kelurahan Level) Collection Target Level of Service**

The most effective manner in which residential solid waste may be brought to a collection point would be through door-to-door collection using push carts. To provide optimum coordination of the collection activity, this service would best be provided by each kelurahan working in coordination with the kecamatan in which they are located. This would allow the kelurahan to coordinate the function of cart collectors (employed by them or a contractor) with secondary collection provided by the kecamatan or the BPK.

The cost of a door to door collection service will be a function of a number of factors including:

- The density of housing or number of collection stops that would have to be serviced.
- The distance that a cart operator collecting solid waste door-to-door would have to travel to deposit that solid waste in a TPS or container.

A good model for establishing and paying for this form of primary collection may be found in Kelurahan Ronatana in Kecamatan Sario. This kelurahan was the recent winner of a cleanliness competition in the City. (A profile of this competition and the SWM management practices in Kelurahan Ronatana is presented in Annex D.)

If a decision was made at the kelurahan level not to provide door-to-door collection, sufficient TPS locations will have to be established to make it convenient for residential generators to bring their solid waste to them. Convenience should be defined by providing sufficient TPS or container collection points so that any residential generator would not

have to travel over 100 meters to deposit their solid waste. This will require a significant expansion of the number of TPS or containers throughout the City.

### **6.3 Recommended Secondary (Kecamatan/BPK) Collection Level of Service**

The level of service to be provided by the kecamatan and the BPK secondary collection program must be sufficient to assure that all collection points are regularly and effectively serviced on a reliable schedule that establishes performance parameters for the generators and kelurahan door-to-door collection programs. Two approaches are available to the kecamatan in providing secondary collection. The first of these, which is consistent with current practice, would require expansion of the TPS locations or deployment of new containers that would receive solid waste from generators or kelurahan collectors. New locations should be based on specific analysis of the conditions and needs in each neighborhood.

In the second approach, a “just in time” or “block” process can be utilized whereby kecamatan collection vehicles go a predetermined location at the same time each day for receipt of solid waste from cart collectors who also plan their activities to be at the transfer point at the established time. While this approach requires closer coordination between the kecamatan and kelurahan programs, it does provide better utilization of vehicles and cart storage. The recommended target level of service is to provide the means for collecting solid waste within the primary collection system daily. The target level of service should also attempt to only collect solid waste from formal collection points through elimination of illegal dumping by means of enhanced enforcement and providing additional collection points. A needs assessment based on criteria defined in Appendix F should form the basis for determining specific needs to achieve the targeted daily collection in each kecamatan.

### **6.4 Commercial/Industrial Waste**

The current practice where large commercial establishments provide their own means of transporting solid waste to the TPA is a reasonable level of service and should continue. Small scale commercial/industrial generators should be integrated into the residential collection program and subject to any of the requirements that will emerge from enhancing the primary and secondary collection processes. This integration should include consideration of the small scale commercial/industrial generator waste in completing a service needs assessment in each kecamatan and kelurahan.

### **Effect of Other Integrated SWM Processes on Target Levels of Service**

A sustainable and effective collection level of service will be affected by other SWM program elements. For example, the development of effective recycling programs can help to reduce the amount of waste that must be collected or requiring disposal. Currently, the only recycling that occurs in Manado is that done by 1) scavengers who retrieve materials from the collection system or at the disposal area or 2) collection personnel who retrieve materials while they provide their collection service. While the segregation of recyclables by collection staff can help to augment their income, the segregation should not be done in a manner that affects the efficiency of the crew's core responsibilities.

The disposal area location and operation can have a significant effect on the efficiency of the collection program. Travel time between the collection routes in each kecamatan to the TPA will vary depending on their relative locations and the nature of roads that must be traveled to reach the TPA. The distance between the collection routes and the disposal area as well as the traffic conditions that are experienced are the primary factors in determining how long it takes for a solid waste collection vehicle to travel from its collection route to the disposal area. In solid waste collection, this time is normally referred to as "non-productive time" in that the core function of the collection crew, which is to pick up solid waste, is not being accomplished. The primary intent of any collection system design is to maximize the amount of time that a collection crew actually spends collecting solid waste and minimize the time that it takes to bring that solid waste to the disposal area and to return to the collection route. In many situations, there is an economic justification for constructing transfer stations to maximize the time that collection crews actually spend on their collection routes. The economic justification for a transfer station is generally a function of the distance over which solid waste must be transported to reach the disposal area. The greater the distance to be traveled, the greater the economic justification for considering a transfer facility that allows consolidation of solid waste and transfer in, possibly, more efficient larger vehicles than those used in collecting solid waste.

The physical conditions at the disposal area can also have a significant effect on the efficiency of the collection program. For example, disposal area conditions may be such that it takes a long time for solid waste to be offloaded once the truck has reached the disposal site. This adds to the non-productive time that the collection personnel experience each day. In addition, conditions of the disposal area may be such that they increase the wear and tear on collection equipment thereby requiring a greater level of maintenance and repair. This can lead to increased breakdowns that influence collection efficiency or a premature need to replace a vehicle to maintain the desired level of service.

## Section 7

### Recommended Strategies and Models

Potential strategies to improve SWM in Manado must address issues related to all of the current participants in the City's solid waste collection program. The intent of an effective collection program must be to maintain full control of the solid waste from its point of generation to final disposal. Failure of any of the principal parties to properly handle solid waste while it is in their care can lead to the overall failure of the solid waste collection program. Accordingly, any strategy to improve solid waste collection in Manado must address the ability and willingness of each party to fulfill their responsibility. While many of the participants may recognize their responsibility and act accordingly, others may not thereby requiring enforcement of applicable laws and regulations.

Potential strategies relevant to each of the key SWM program participants are shown in Figure 7.1 which also identifies the desired results to be achieved as well as the steps by which the desired result can be achieved.

Figure 7.1  
**SOLID WASTE COLLECTION IMPROVEMENT STRATEGIES**

PARTICIPANT	OBJECTIVE	STRATEGY
<b>Solid Waste Generator</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Eliminate illegal dumping and litter</li> <li>✓ Use TPS/containers in the correct manner</li> <li>✓ Participate in regular neighborhood cleanups</li> <li>✓ Pay reasonable fees for service</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Accept and be subject to greater enforcement</li> <li>✓ Increase public awareness of the consequences of SWM issue</li> <li>✓ Accept increased fees linked to better service</li> <li>✓ Adopt reasonable standards for the manner in which their solid waste is stored packaged and transported to collection points</li> <li>✓ Participate in City, Kecamatan and Kelurahan sponsored SWM programs</li> <li>✓ Participate in regularly scheduled clean - up programs</li> </ul>
<b>Kelurahan/ Lingkungan</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater control of solid waste conditions in their jurisdictions</li> <li>✓ Implementation of door to door collection</li> <li>✓ Clean-up of drainage channels and courses</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Accept responsibility for primary collection in the kelurahan and lingkungan</li> <li>✓ Increase knowledge and capacity to evaluate SWM issues</li> <li>✓ Perform needs analysis of their districts and subdistricts</li> <li>✓ Establish cost effective and sustainable door to door collection for their districts</li> <li>✓ Recommend and implement new collection points in conjunction with kecamatan</li> <li>✓ Develop special programs for areas with special problems such as densely populated poor areas or riverfront areas</li> <li>✓ Sponsor (along with Kecamatan) annual clean-up of district and drainage structures</li> <li>✓ Implement recycling and compost programs</li> </ul>
<b>Kecamatan</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater coordination with Kelurahan and BPK</li> <li>✓ Increased collection efficiency</li> <li>✓ Clean-up of drainage channels and courses</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Increase capacity to evaluate SWM collection issues</li> <li>✓ Develop 5 year plan for collection system improvements in conjunction with BPK</li> <li>✓ Perform needs analysis for their collection program in conjunction with Kelurahan level needs analysis</li> <li>✓ Establish full cost operating budget for solid waste collection function under their jurisdiction</li> <li>✓ Support Kelurahan special programs for areas with special problems such as densely populated poor areas and riverfront areas</li> <li>✓ Sponsor and support (along with Kelurahan) annual clean-up of district including drainage structures</li> <li>✓ Perform service needs assessments in coordination with each kelurahan</li> <li>✓ Assist the kelurahans in performing needs assessment for their subdistricts</li> <li>✓ Increase number of TPS/containers locations and collection equipment to service them</li> <li>✓ Evaluate and implement just-in-time or block collection</li> </ul>
<b>Municipality</b>	<b>Desired Result</b> <ul style="list-style-type: none"> <li>✓ Greater coordination with Kecamatan</li> <li>✓ Improved infrastructure planning</li> <li>✓ Development of common performance standard throughout City</li> </ul>	<b>How To Accomplish Desired Result</b> <ul style="list-style-type: none"> <li>✓ Revise and update 5 year plan to action mode</li> <li>✓ Develop reasonable and sustainable level of SWM performance by Kecamatan</li> <li>✓ Monitor and report SWM performance by participants on regular basis</li> <li>✓ Assist the kecamatan in providing technical assistance to their kelurahans</li> <li>✓ Establish full cost operating budget for solid waste function under their jurisdiction</li> <li>✓ Implement reasonable cost recovery programs</li> <li>✓ Support special programs for areas with special problems such as densely populated poor areas and riverfront areas</li> <li>✓ Sponsor and support (along with Kecamatan and Kelurahan) annual clean-up of district including drainage structures</li> <li>✓ Support and push for greater enforcement of existing laws and regulations</li> <li>✓ Develop and implement ongoing public awareness programs relative to solid waste management</li> <li>✓ Provide support for recycling and compost programs</li> <li>✓ Construct transfer depots that may serve more than one Kecamatan</li> <li>✓ Locate and implement new TPA on opposite sides of City</li> <li>✓ Provide technical assistance and coordination to kecamatan for local needs assessments and capacity building</li> </ul>

#### 7.1 Solid Waste Generators

- ✓ **Accept and be subject to greater enforcement** – Solid waste generators must be willing to accept and understand the reason for stricter enforcement of solid waste and litter laws. Their support of effective enforcement programs aimed at litter control will be important to the overall success of Manado's SWM program. Peer pressure as to how

people act in individual neighborhoods will also be an important factor in maintaining the desired conditions.

- ✓ **Increase public knowledge and awareness of SWM issues** - Solid waste generators must respond positively to information presented on solid waste management issues in Manado. Increased awareness of SWM issues is intended to provide greater motivation for the required individual actions necessary for effective solid waste management at the generator and primary collection level. Public awareness programs should be developed by the PBK working in conjunction with the kecamatan. These public information programs should focus on the roles and responsibilities that individual solid waste generators have in the overall SWM program. As one of its key elements, this project will make use of the Lestari process developed in association with the Natural Resources Management (NRM) program in Manado. This multimedia public information program will provide a basis by which increase public awareness of SWM issues can be realized. This program may form the basis for an ongoing public awareness program aimed at SWM issues.
- ✓ **Accept increased fees linked to better service** – Better solid waste management services may mean increased costs. Public information should include data as to the manner in which solid waste management services are paid for and the improvements that will be realized from increased payments. This data should provide a clear understanding that any new fees collected at the kelurahan level are intended for specific services to be provided within their neighborhoods. New fees that may be collected for door to door or other enhanced primary collection should be clearly linked to the improvement of services that can be observed in individual neighborhoods.
- ✓ **Adopt reasonable standards in the manner which their solid waste is stored, packaged and transported to collection points** - Individual solid waste generators must adopt reasonable standards for their own performance within the overall solid waste management program. Public information should be provided that includes a definition of what is expected of them in managing their waste until it is collected or placed in a communal collection structure. Information should be provided to generators concerning the manner in which they must store and manage their waste materials while it is in their possession. To the degree possible, generators should be provided with instructions that help standardize their waste management procedures.
- ✓ **Participate in City, Kecamatan and Kelurahan sponsored SWM programs** - Individual solid waste generators must be prepared to understand and fulfill their role in the solid waste management particularly in the function of the primary collection program.
- ✓ **Participate in regularly scheduled clean-up programs** - The overall SWM program in Manado should include periodic cleanup efforts aimed at addressing waste accumulations. Waste generators should be prepared to participate in such programs in their neighborhoods since they are the primary beneficiaries of these local efforts. This will help to foster an improved standard for controlling litter and improper dumping of solid waste.

## 7.2 Kelurahan

- ✓ **Accept the responsibility for primary collection in the kelurahans and lingkungan** – Kelurahan should accept responsibility for primary collection in their districts. This responsibility may include implementation of cart based door-to-door collection or establishment of properly placed and sufficient TPS or container collection points to

serve their residences and businesses. If possible, door-to-door collection should be implemented based on the Kelurahan Ronatana model. All Kelurahan functions should be closely coordinated with Kecamatan secondary collection programs.

- ✓ **Increase knowledge and capacity to evaluate SWM issues** - Kelurahan officials should endeavor to develop a better understanding of solid waste management issues including the ability to assess conditions within their own jurisdictions as well as administer kelurahan-sponsored primary collection programs. If possible, one person in each kelurahan should be responsible for the primary collection program and coordination of kelurahan activities with the Kecamatan administration and the BPK.
- ✓ **Perform needs analysis of their districts and subdistricts** - Kelurahan officials should be provided the knowledge, tools and models by which to perform initial needs analyses for their districts as well as to monitor solid waste management practices and needs on a regular ongoing basis. Criteria for needs assessments in each kelurahan is presented in Appendix E. In addition, a primer for needs assessment and analysis has also been developed within the project. The project will also undertake a full needs assessment for one of the City's kelurahan as part of its pilot program function.
- ✓ **Implement cost effective and sustainable door-to-door collection for their districts based on the Kelurahan Ronatano model** - Kelurahan officials should endeavor to implement cart-based door-to-door collection and to establish reasonable user fees for these services that are affordable and sustainable. In addition, each kelurahan should develop the means by which the performance of the primary collection system can be closely monitored and adjusted as necessary.
- ✓ **Recommend and implement new collection points in conjunction with Kecamatan administration** - Based on the needs analysis performed for their service areas, kelurahan officials should be prepared to assist kecamatan officials in implementing new collection points (TPS or containers) for transfer of the solid waste from the primary kelurahan-based collection system to the secondary kecamatan-sponsored program. New collection points will be required irrespective of whether a kelurahan adopts a door to door collection approach or still places the burden of getting solid waste to the collection points on the generators.
- ✓ **Develop special programs for areas with unique collection problems such as densely populated poor areas or riverfront areas** - Kelurahan officials should, with the assistance of the kecamatan and BPK, identify and evaluate the specific needs for areas with unique collection problems. They should also develop a means by which solid waste can be effectively collected from these areas on an ongoing and sustainable basis. Defining and addressing such areas will be an important element of a needs assessment.
- ✓ **Sponsor (along with kecamatans) annual clean-up of district roads and drainage structures** - Kelurahan officials, working in conjunction with kecamatan and BPK officials, should co-sponsor annual cleanup programs to assist in the maintenance of clean conditions throughout their districts. This work should include close coordination with the kecamatan and city agencies responsible for solid waste management. So as to prevent solid waste from reaching Manado Bay, particular emphasis should be placed on cleaning drainage structures and removing accumulated solid waste.
- ✓ **Implement recycling and compost programs** - Working in conjunction with the kecamatan and BPK officials, kelurahan officials should develop or support the development of recycling and compost programs aimed at reducing the quantity of solid

waste require ultimate disposal. This may include compost programs where segregated organic materials can be used to make compost that can be used in the kelurahan service area. One of the project pilot programs will demonstrate the manner in which this can be accomplished.

### 7.3 Kecamatan

- ✓ **Increase capacity to evaluate SWM collection issues** - Kecamatan officials should endeavor to increase their technical capacity and knowledge to evaluate solid waste management and collection issues within their districts. This may include participation in BPK sponsored programs. To the degree possible kecamatan officials should also attempt to pass on relevant information to kelurahan officials within their service area.
- ✓ **Develop 5 year plan for collection system improvements in conjunction with BPK** - Working in conjunction with the BPK, kecamatan officials should prepare a five-year action plan for maintenance and improvement of collection services in their districts. This action plan should include budget projections as well as projections for replacement or new equipment required to sustain an effective level of service and, where necessary, increase the collection service area within their kecamatan. This will help to establish program accountability for kecamatan performance.
- ✓ **Establish full cost operating budget for solid waste function under their jurisdiction** - Working in conjunction with the BPK, kecamatan officials should develop full cost budgets for provision of secondary solid waste collection services within their districts. These budgets should be prepared on the basis of full cost accounting for services provided at a reasonable and sustainable level of service. Budgets should also include some elements aimed at supporting kelurahan-level primary collection activities.
- ✓ **Support Kelurahan special programs for areas with unique problems such as densely populated poor or riverfront areas** - Kecamatan officials should provide assistance to its kelurahans in providing primary collection in areas with unique problems such as densely populated poor or waterfront areas. This assistance should include provisions for special equipment or collection coordination in conjunction with service for these unique areas. The required activities to provide service to unique area should be identified during the needs analysis performed for each kelurahan.
- ✓ **Sponsor and support (along with Kelurahan) annual clean-up of their districts including roadways and drainage structures** -Kecamatan officials should sponsor and support annual cleanup of their districts. This should be done in conjunction with ongoing public awareness programs aimed at understanding the benefits of a cleaner environment and neighborhoods. Support should include the coordination of kecamatan collection resources with special area cleanups sponsored at the kelurahan level. So as to minimize solid waste transport to Manado Bay, clean-up programs should give due attention to solid waste accumulation in drainage structures and water courses.
- ✓ **Perform service needs assessments in coordination with each kelurahan** – Working in conjunction with the BPK, each kecamatan should undertake a needs assessment aimed at determining the specific improvements that are required to improve secondary collection services in their districts. The needs assessment should identify existing solid waste collection resources (TPS, container locations, etc.) and identify deficiencies in providing the target level of service.
- ✓ **Assist the kelurahans in performing needs assessment for their subdistricts** – The kecamatan should assist the kelurahans in performing needs assessments associated with



the primary collection program to be administered by the kelurahans. This assistance will help to provide greater coordination between the kelurahan primary and the kecamatan secondary collection programs. It will also help to assure that there is a consistent level of service in all kelurahan within the kecamatan.

- ✓ **Increase number of TPS/containers locations and collection equipment to service them** - Working in conjunction with the kelurahans and BPK, the kecamatan officials should plan for and implement new TPS/container locations for enhanced solid waste collection.
- ✓ **Evaluate and implement just-in-time or block collection** - Working in conjunction with kelurahan officials, evaluate the potential of just-in-time collection for specific kelurahan or districts within their service area.
- ✓ **Enhance the role of community based organizations and NGOs in solid waste management** – Working in conjunction with the kelurahan, coordinate and enhance the involvement of CBOs and NGOs in primary solid waste collection programs as well as in developing recycling and compost opportunities.

#### 7.4 Municipality

- ✓ **Revise and update 5 year plan to action plan mode** - City officials should periodically update Manado's five-year solid waste management plan so as to plan and implement system improvements and capitalization of new and expanded equipment resources. The BPK should be required to submit an annual report to the Mayor concerning progress in the implementation of the five year plan.
- ✓ **Develop reasonable and sustainable level of SWM performance standards for all Kecamatans** - A minimum standard for primary and secondary solid waste collection throughout the city should be established by BPK. Training should be provided to each kecamatan and kelurahan relative to the attainment of the standard.
- ✓ **Monitor and report SWM performance by participants on regular basis** - Based on the adopted reasonable and sustainable level of service, the BPK should monitor the performance of each kecamatan in providing secondary solid waste collection. To the degree possible, performance monitoring should accompany budget preparation efforts at each kecamatan so as to associate their level of performance with the level of funding to be received.
- ✓ **Assist the kecamatan in providing technical assistance to their kelurahans** – The BPK should provide technical assistance to the kecamatan in helping them train and educate kelurahan and lingkungan officials in the proper planning, implementation and operation of primary solid waste collection.
- ✓ **Establish full cost operating budget for solid waste function under their jurisdiction** - Solid waste collection elements provided directly by the city should be defined under a full cost accounting budget process that is based on a reasonable and sustainable level of service that is consistent throughout the City. This budget assessment should be tied into the City's five year plan. Clear accounting of general functions that apply to all kecamatan such as the repair and maintenance of mechanized equipment should be clearly defined.
- ✓ **Implement reasonable cost recovery programs** – The City should develop greater cost recovery for solid waste management activities. This, however, should be associated with a strong public awareness effort that defines the benefits that will be achieved through increased cost recovery. The City's five year plan should integrate a

program of greater cost recovery tied to improvements that can be observed by the people or entities that may be asked to pay additional fees.

- ✓ **Support special programs for areas with unique problems such as densely populated poor areas** - BPK solid waste personnel should provide planning and technical assistance to the kecamatan and kelurahan in supporting areas with unique problems within those jurisdictions.
- ✓ **Sponsor and support (along with Kecamatan and Kelurahan) annual clean-up of district including drainage structures** – The BPK should provide assistance (economic and technical) to annual cleanup programs implemented at the kecamatan in kelurahan levels. This may involve use of BPK containers and trucks in areas where special clean-up projects are being implemented. In addition, the BPK should assist in the coordination of such programs and in providing public information associated with them.
- ✓ **Support and push for greater enforcement of existing laws and regulations** - City officials responsible for solid waste management should endeavor to urge city elected officials to implement greater enforcement of litter and solid waste management laws. In this context, PD Pasar should also adopt stricter enforcement of litter control and solid waste management associated with all formal markets under its jurisdiction. A particular emphasis should be placed on market area that are in proximity to Manado Bay since these can serve as a direct source of waste that reaches the bay.
- ✓ **Develop and implement ongoing public awareness programs relative to solid waste management** – An ongoing public awareness program is mandatory if successful solid waste management is to be achieved in Manado. This program should attempt to assertively provide information to the people of Manado on an ongoing and regular. The intent of this program should be to educate the residential and other solid waste generators as to their responsibilities within an integrated program. The program should also focus strongly on improvements that are made in the City's SWM program and the means that are being developed to fund them..
- ✓ **Provide support for compost/recycling programs** – All solid waste management programs are enhanced by minimizing the amount of solid waste that must be handled. Properly developed recycling and compost activities can assist in accomplishing this. Brokers exist in Manado who buy materials of value from scavengers. Recycling programs should be fostered to allow recovery of materials that can be sold to these brokers. BPK should work with PD Pasar to develop recycling and compost programs for the City's market areas. To the degree possible, organic material from the market area should be diverted to compost programs. Derived compost may then be used for improving the aesthetic conditions at Manado's market places.
- ✓ **Construct transfer depots that may serve more than one Kecamatan** – The efficiency of any collection system is a function of maximizing the amount of time that a collection crew actually spends collecting solid waste. Time spent transporting solid waste to remote disposal areas can be time consuming. Transfer depots provide a basis by which collection efficiency can be enhanced by providing a new location closer to the collection route location at which solid waste can then be transferred to more efficient vehicles (dump trucks, etc.) for transport to the disposal site. Transfer depots can also serve as discharge location for cart-based collectors from neighborhoods in proximity to the transfer depots. Experience has shown that transfer depots may be most feasible in regions of the city that are furthest from available disposal locations.

- ✓ **Locate and implement new TPA on opposite sides of City** – The development of new disposal areas in different parts of the city will allow for a general decrease in the travel distance for kecamatan in proximity to those areas. This will help to increase the efficiency of collection programs by reducing non-productive time.
- ✓ **Provide technical assistance and coordination to kecamatan for local needs assessments and capacity building** - The BPK should provide an ongoing means by which technical assistance is provided to the kecamatan in maintaining a minimum level of technical capacity and knowledge associated with solid waste management issues. In its initial planning efforts, the BPK should assist the kecamatans and kelurahans to understand the manner in which needs assessment can be completed for their particular districts.

## Section 8

# Key Implementation Action Strategies

There are a number of key activities that may be used to implement the recommended solid waste collection strategies. To some degree, each of these may be applied to all of the major SWM participants including the BPK, kecamatan and kelurahan administrative levels and individual solid waste generators.

### 8.1 Private Sector Involvement

In the future, the role of the private sector in solid waste management may become more prominent in Indonesia. In many countries, private companies have been able to bring the required capitalization and operating efficiencies that have helped municipalities save money while achieving better SWM results. However, experience with such approaches has been minimal in Indonesia.

A private contractor might provide a means for incorporating more sophisticated technology in achieving solid waste collection, treatment or disposal. However, asking a private contractor to bring in new equipment that would increase SWM effectiveness and efficiency requires a clear recognition that this new equipment and improved services may increase the costs to be borne by the municipality and its residents.

Utilization of a private contractor also allows the establishment of performance standards that the contractor is required to follow. Performance standards may be defined in the contract that they may sign for the work. For example, if BPK hired a private contractor to perform container collection services, the BPK could require a minimum level of service as a condition of the contract. This would allow BPK to monitor performance of the contractor for good service. In many areas where private sector contracts have been established, penalties are often stipulated in contracts for poor performance. This serves as an incentive to maintain the desired level of service.

Currently, there is also a potential role for micro-enterprises in Manado to provide door-to-door collection services in each kelurahan. One issue that would need to be evaluated would be the manner in which these micro-enterprise contractors would be paid. There are two basic alternatives that can be considered. In the first, the contractor is paid directly by the residential or commercial waste generator for the service of collecting the solid waste every day and bringing it to a TPS. In the second alternative, the kelurahan pays the contractor to perform the required door-to-door service. In turn, the kelurahan would seek to collect a fee from generators for the government sponsored service.

### 8.2 Public Awareness, Cooperation and Participation

Strong public awareness of solid waste management issues is critical if Manado's current solid waste problems are to be corrected. Public attitudes towards litter and the improper dumping of solid waste must be adjusted so as to not place an additional burden on the collection program. The public awareness program needs to create a clear link between the roles that each residential solid waste generator has in the efficiency of the overall collection system and its success. It also needs to create a means by which generators can feel that they “own” the solutions that are implemented. This requires that the means for soliciting public input into the SWM planning process be developed.

One of the key aspects in gaining public acceptance of any new approach toward solid waste collection is to make sure that the proposed system meets the perceived needs of the community. In low income areas, solid waste management may not be the highest priority. For example, a survey was conducted in Yogyakarta, Indonesia showed that expenditures such as those on food (which may be as high as 50 to 80% of incomes), housing, clothing, electricity and education were viewed to be higher priorities than solid waste management. This often places the views of community members at a different focus than those of decision makers who are more likely to focus on environmental protection and public health issues. While it's important to make sure that residential generators are aware of the negative aspects of improper solid waste management, it is also extremely important that any new or enhanced collection system meets their perceived needs which may be more oriented towards convenience and aesthetics.

It's also important to recognize that solid waste management collection requires the significant participation of residential generators who may be involved in storage of the waste in households, transporting of the waste to roadside or communal containers, and the payment of user fees. Because of this, the capacity and willingness of households to contribute to the service is extremely important. This, therefore, establishes a priority for low-cost rather than high technology solutions that might be prevalent in more industrialized countries.

The public awareness program should also attempt to create a clear link between the actual cost of a reasonable level of collection service and generator willingness to pay. Throughout the world, experience has shown that people are willing to pay more for an improved level of service. However, in some locations, fees have increased without realizing a significant improvement in service. This then became an impediment to creating additional revenues required to enhance services.

There are numerous forms of community participation including:

- Individual participation
- Collective participation
- Material or financial contributions
- Active participation in formulating projects

Each of these should be part of the regions SWM program. To help in providing information to the public concerning solid waste management issues, the project will use the Lestari process to communicate its findings to the residence of Manado. This process is described on the multimedia information dissemination process is described on the following pages.

### **8.3 Cost Recovery and Financial Resources**

To the degree possible, there should be a clear link between the actual cost of solid waste collection services and the revenues that generators must pay for them. The ideal situation would be where revenues derived for SWM services would be equal to the overall costs of the program. Residential generators must be educated to the fact that there are different components to the SWM services that they receive. For example, a direct payment for door-to-door collection is solely for that service whereas the actual cost of solid waste collection borne by the kecamatan and the cost of operating the TPA by the BPK must also be funded in some manner such as the collection of Retribusi collected in conjunction with the utility bills.

### **Lestari Multi Media Machine**

The Lestari process is currently sponsored by USAID's NRM III and was designed to examine natural resources management issues of North Sulawesi in the

<b>Lestari Multi Media Machine Criteria</b>	
<b>Name</b>	<b>Lestari Element</b>
Province	North Sulawesi
Newspaper Partner	Manado Post
Started	September 2001
No. Monthly Issues	24
No. Copies Published/Month	23,000
Estimated Print Readership	180,000
On Line Readership	4,000/day (Manado Post)
Additional Provinces Reached	Makasar, Balikpapan, Jakarta, Ternate, Palu
Radio Program	Suara Lestari
Est. Radio Reach (Partner: RRI)	Minahasa, Manado, Bitung
TV Program	Lestari Alamku
Estimated TV Reach (Partner: Bunaken TV)	Manado
Editorial Board or Governing Body	Manado Post, Bunaken TV, RRI Pro2
Content Contributors	NRM Program Partners, University Officials, Local Gov. Officials, NGOs <b>Specific:</b> Unsrat, CRMP, WCS, PSL-UNSRAT, Bappedalda, Bapeda
Financial Contributors	NRM/USAID, CRMP, IFES
Journalist field trip	15 journalist from 12 local media
Average coverage (in local media: radio, TV and Newspaper)	5 per week (article, talk show and news) (due to the journalist field trip)

Cost recovery mechanisms often used in SWM are shown in Table 8.1 which also presents a summary of experience with use of these mechanisms across the world. It is noteworthy that all of the mechanisms are difficult to implement from a political perspective. However, since the City has already established a basis of collecting SWM fees through the utility bill, the opportunity to increase fees to the level required for an effective service may already exist.

Table 8.1  
**SWM Cost Recovery Options**

<b>Mechanism</b>	<b>Can adequate revenues be generated?</b>	<b>Can the revenues be easily collected?</b>	<b>Does the polluter pay more?</b>	<b>Is it politically difficult to use this mechanism?</b>	<b>Is the mechanism easily enforced?</b>
<b>USER CHARGES</b>					
Solid Waste Tax	Yes	No	Not Always	Difficult	No
Volumetric Charges	Yes	No	Yes	Difficult	No
Tipping Fee	Yes	Yes	Yes	Difficult	Sometimes
<b>OTHER SOURCES</b>					
Property Tax	Yes	Yes	No	Difficult	No
Business License Fees	Yes	Yes	No	Difficult	Yes
Utility Surcharge	Yes	Yes	Not Always	Difficult	Yes
Grants and Donor Support	Yes	Yes	No	Difficult	No



#### **8.4 SWM Technical Capacity Building**

Training should be provided for all personnel especially kecamatan and kelurahan leaders and staff on all aspects of solid waste collection including needs assessment, equipment maintenance, and route analysis and structure. This should appropriately be the responsibility of the BPK since they should be responsible for attempting to apply a consistent level of service throughout the City. This project seeks to provide a means for furthering this capacity building process through the development of primers aimed at a number of SWM issues including needs assessment and collection practices. In addition, a workshop will be conducted for local (BPK, kecamatan and kelurahan) leaders and staff on key SWM issues.

## **Appendices**

**Appendix A - List of Acronyms**

**Appendix B - Profiles - Kecamatan Solid Waste Management**

**Appendix C - Profiles – Recyclable Markets in Manado**

**Appendix D - Profile – Cleanliness Award Programs in Manado**

**Appendix E - Needs Assessment Criteria for BPK/Kecamatan/Kelurahan  
Evaluation**

**Appendix F - Sustainable Solid Waste Management Practices Summary**

## Annex A

### List of Acronyms

ADB	Asia Development Bank, a multilateral development bank, based in Manila
BAPPEDA	Badan Perencanaan Pembangunan Daerah, Regional Development Planning Board (at provincial and kabupaten/kota levels)
BAPEDAL	Badan Pengelolaan Dampak Lingkungan, Environmental Impact Management Agency. Regional offices called Bapedalda (“da” for daerah or region).
BAPPENAS	Badan Perencanaan Pembangunan Nasional National Development Planning Board, the GOI sponsor of the NRM Program
BPD	Badan Perwakilan Desa. Village Assembly. Under UU22/1999 this body governs with the village chief or lurah.
BPK	Badan Pengelola Kebersihan Kota Manado. Manado’s Garbage Agency (before Perda 13/2000: Dinas kebersihan).
CBIUIM	Capacity Building in Urban Infrastructure Management – a project supported by the Asia Development Bank
CBNRM	Community based natural resources management
CBO	Community based organization
DPR	National Parliament of Indonesia
DPRD	Local elected Assemblies/Councils at the province (provinsi) and district/municipality (kabupaten/kota) levels
DPTNB	Dewan Pengelolaan Taman Nasional Bunaken, Bunaken National Park Management Council
GOI	Government of Indonesia
IUIDP	Integrated Urban Infrastructure Development Project, a standard World Bank loan package for urban infrastructure projects in Indonesia
Kabupaten	District or Regency (archaic). Primary unit of governance in a province.
Kecamatan	Sub-district. Between a kelurahan and a kabupaten/kota.
Kelurahan	Urban village – lowest formal division of government, empowered under UU 22/1999; in rural areas called a desa or village, where leadership is still community elected.
Kota	Urban municipality; a designation equivalent in governance powers and status to a kabupaten.
LSM	Lembaga Swadaya Masyarakat, community self-reliance institution, the Official term for a registered Indonesian NGO
MSW	Municipal Solid Waste
NGO	Non-governmental Organization

NRM	Natural Resources Management, the subject and the USAID-funded Program
NRM/EPIQ	Natural Resources Management Program/Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
PDAM	Perusahaan Daerah Air Minum (government-owned) Drinking Water Utility.
PPIS	Monitoring and technical support contractor for the World Bank's Second Sulawesi IUIDP (q.v.) based in Manado.
Propenas	Program Pembangunan Nasional, National Development Program, from October 1999 replaces Repelita for essentially the same function
Rs	Rupiah (currency of Indonesia)
RT	Rukun Tetangga or Neighborhood Association is the primary unit of organization (semi-official) in urban and rural villages.
RW	Rukun Warga or Citizens Association consists of a group of neighboring hamlets. Called Lingkungan in Manado
SWM	Solid waste management
TPA	Tempat Pembuangan Akhir or disposal area
TPS	Tempat Pembuangan Sementara or Temporary waste storage location
UNSRAT	Sam Ratulangi [State] University, in Manado, North Sulawesi
USAID	United States Agency for International Development
Walikota	A city mayor.

## **Annex B**

### **Profile - Kecamatan Solid Waste Management**

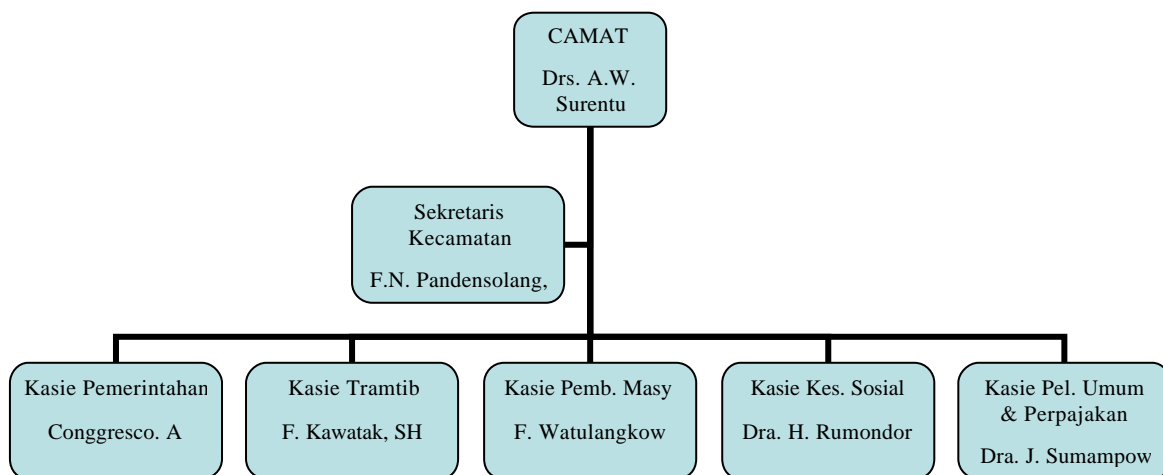
The following pages present individual demographic and solid waste management profiles for each Kecamatan in Manado.

## PROFIL KECAMATAN BUNAKEN

Kecamatan Bunaken terletak paling utara dengan luas 5.125,29 ha.

Batas administratif :   Utara               Kabupaten Minahasa  
                                   Selatan       Kecamatan Tuminting  
                                   Timur        Kecamatan Mapanget  
                                   Barat        Teluk Manado

Jumlah Penduduk Kecamatan Bunaken pada Tahun 2003 adalah 21.712 jiwa dengan 5.167 KK dan tingkat kepadatan penduduk rata-rata 4.24 jiwa/ha.



Struktur Organisasi Kepemerintahan Kecamatan Bunaken

Kecamatan Bunaken terdiri atas 8 Kelurahan yang meliputi :

1. Tongkeina
2. Molas
3. Meras
4. Builang
5. Bunaken
6. Alung Banua
7. Manado Tua I
8. Manado Tua II

Dari delapan kelurahan pada kecamatan Bunaken yang tidak menerima pelayanan angkutan sampah meliputi 4 kelurahan yang berada di kepulauan Bunaken yaitu Kelurahan Bunaken, Kelurahan Alung Banua, Kelurahan Manado Tua I dan Kelurahan Manado Tua II.

Sarana dan prasarana pengelolaan persampahan di kecamatan Bunaken meliputi :

- |                    |         |
|--------------------|---------|
| a. Dump Truck      | - unit  |
| b. Truck Khas Kayu | 1 unit  |
| c. Truck Khas Besi | - unit  |
| d. Gerobak sampah  | 14 unit |
| e. Container       | - unit  |
| f. TPS             | 1 unit  |
| g. Titik Sampah    | 22 buah |

#### h. TPA Sampah - lokasi

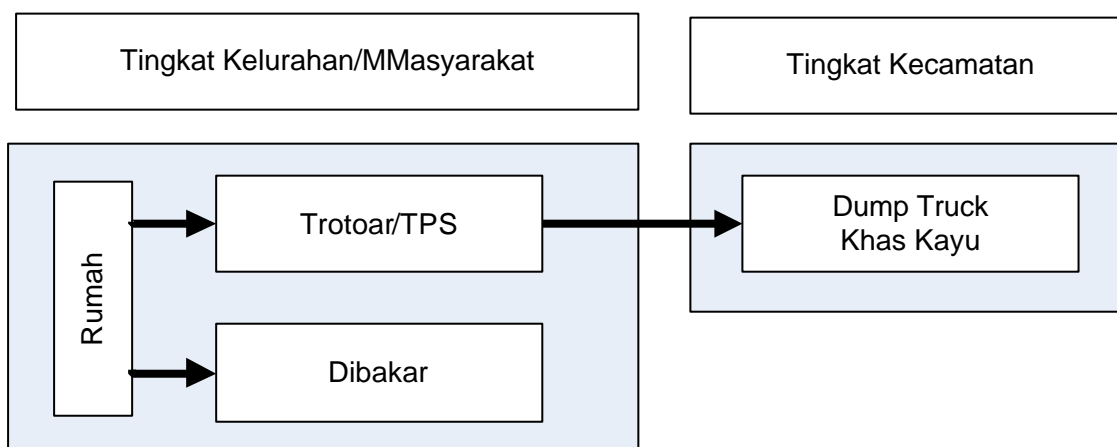
Timbulan sampah pada Kecamatan Bunaken sebesar 54.28 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk), jika berdasarkan kelurahan yang menerima pelayanan angkutan sampah maka timbulan sampah sebesar 36.59 m<sup>3</sup> /hari sedangkan jumlah sampah terangkut sebesar 13.12 m<sup>3</sup>/hari dengan ritasi angkutan perhari 1.83 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Bunaken 9 orang yang terdiri atas 1 orang sopir, 6 orang krew kendaraan dan 2 orang penyapu jalan.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

##### 1. Jalan Pongidon

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan/ membuang sampah ke pinggir jalan/TPS dan container yang dilakukan langsung oleh masyarakat. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar.



Dalam pengelolaan kebersihan di Kecamatan Bunaken untuk tahun 2003 telah dianggarkan dana sebesar- melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003 (belum termasuk ABT). Adapun komponen biaya tersebut meliputi :

- a. Administrasi Proyek : Rp. 6,300,000 - (6.06%)
- b. Biaya operasional : Rp. 89,820,850 - (86.30%)
- c. Biaya pemeliharaan kendaraan : Rp. 7,954,150 - (7.64%)

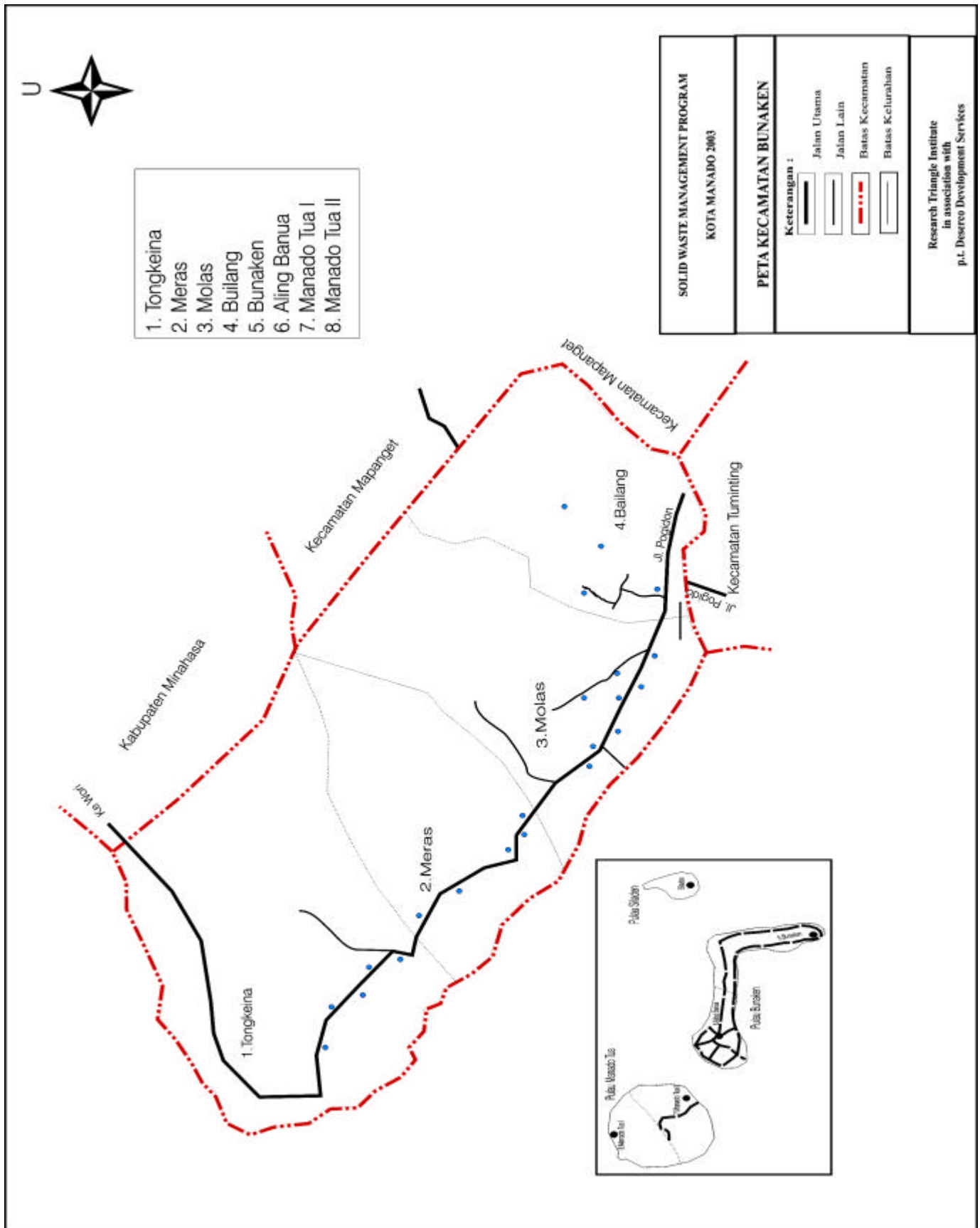
Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Bunaken secara fisik berada pada bagian utara Kota Manado dan langsung berbatasan dengan Kabupaten Minahasa. Kondisi topografi memiliki kemiringan yang bervariasi, untuk daerah yang relatif berbukit dengan kemiringan 25–75% terdapat pada bagian timur sedangkan pada daerah bagian barat merupakan daerah pesisir dengan kemiringan lereng berkisar 10-25%, daerah kepulauan memiliki kemiringan lereng <15% kecuali Manado Tua dengan kemiringan tanah mayoritas > 25%. Kecamatan



Bunaken yang luas didominasi oleh lingkungan yang belum terbangun berkisar 95 % dan sisanya merupakan kawasan terbangun dengan kondisi semi permanen dan non permanent (perumahan desa).

KECAMATAN BUNAKEN				
COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>79,789,200</b>	<b>81,930,000</b>	<b>(2,140,800)</b>	
<b>1 Salaries/Wages</b>	<b>67,066,200</b>	<b>75,219,000</b>	<b>(8,152,800)</b>	
<b>Project Administration</b>	<b>4,675,000</b>	<b>6,787,000</b>	<b>(2,112,000)</b>	
Project Leader	1,045,000	1,507,000		(11 x 137.000)
Treasurer	935,000	1,210,000		(11 x 110.000)
Administration Staff	770,000	770,000		(11 x 70.000)
Coordinator of supervisor	1,100,000	2,200,000		(11 x 200.000)
Supervisor	825,000	1,100,000		1(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>62,391,200</b>	<b>68,432,000</b>	<b>(6,040,800)</b>	
Driver	11,422,800	5,678,000		1(334x17.000)
Waste Transport	29,258,400	32,064,000		6(334x16.000)
Street sweeper	21,710,000	25,050,000		5(334x15.000)
Lebaran allowance	-	5,640,000		
Extra trips	-	-		
Health fund	-	-		
<b>2 Worktools</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>3 Fuel</b>	<b>11,523,000</b>	<b>5,511,000</b>	<b>6,012,000</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>-</b>	<b>-</b>	<b>-</b>	
Spare parts				
Inner tube/tire				
Oil				
Repair				
<b>5 Stationery</b>	<b>1,200,000</b>	<b>1,200,000</b>	<b>-</b>	
<b>6 Monitoring cost</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>7 Other cost</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>B MAINTENANCE COSTS</b>	<b>5,935,800</b>	<b>8,719,000</b>	<b>(2,783,200)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>4,275,000</b>	<b>4,275,000</b>	<b>-</b>	
Calculator	275,000			
Typewriter	2,000,000			
Camera	-			
Amplifier TOA	2,000,000			
<b>Total DIKDA (A+B+C)</b>	<b>90,000,000</b>	<b>94,924,000</b>	<b>(4,924,000)</b>	

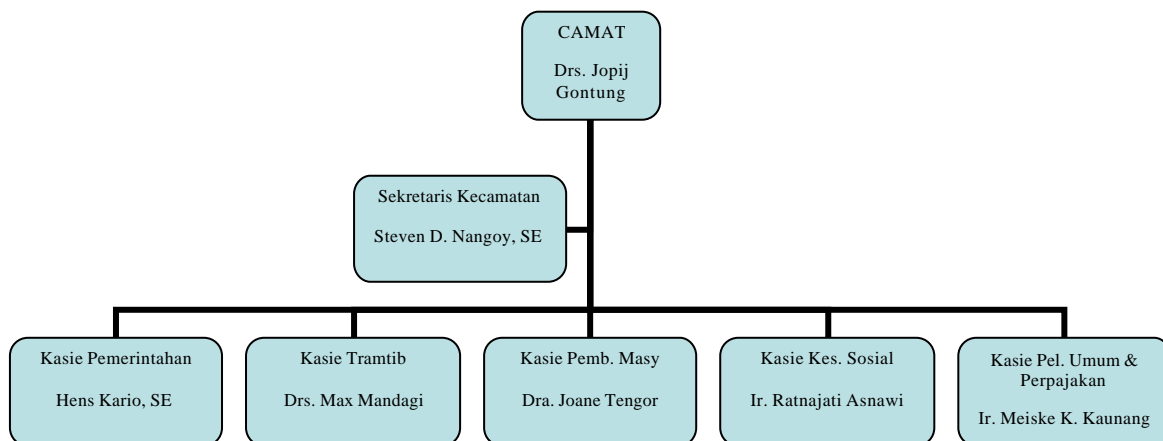


## PROFIL KECAMATAN MALALAYANG

Kecamatan Malalayang terletak di bagian selatan kota dengan luas 1.721 ha.

Batas administratif :   Utara               Teluk Manado  
                                   Selatan       Kabupaten Minahasa  
                                   Timur        Kecamatan Wanea  
                                   Barat       Kabupaten Minahasa

Jumlah Penduduk Kecamatan Malalayang pada Tahun 2003 adalah 54.544 jiwa dengan 12.568 KK dan tingkat kepadatan penduduk rata-rata 31.69 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Malalayang

Kecamatan Malalayang terdiri atas 9 Kelurahan yang meliputi :

1. Malalayang I
2. Malalayang II
3. Bahu
4. Kleak
5. Winangun I
6. Winangun II
7. Malalayang I Timur
8. Malalayang I Barat
9. Batu Kota

Sarana dan prasarana pengelolaan persampahan di kecamatan Malalayang meliputi :

- |                    |            |
|--------------------|------------|
| a. Dump Truck      | : - unit   |
| b. Truck Khas Kayu | : 2 unit   |
| c. Truck Khas Besi | : 1 unit   |
| d. Gerobak sampah  | : 24 unit  |
| e. Container       | : 2 unit   |
| f. TPS             | : 9 unit   |
| g. Titik Sampah    | : 50 buah  |
| h. TPA             | : - lokasi |

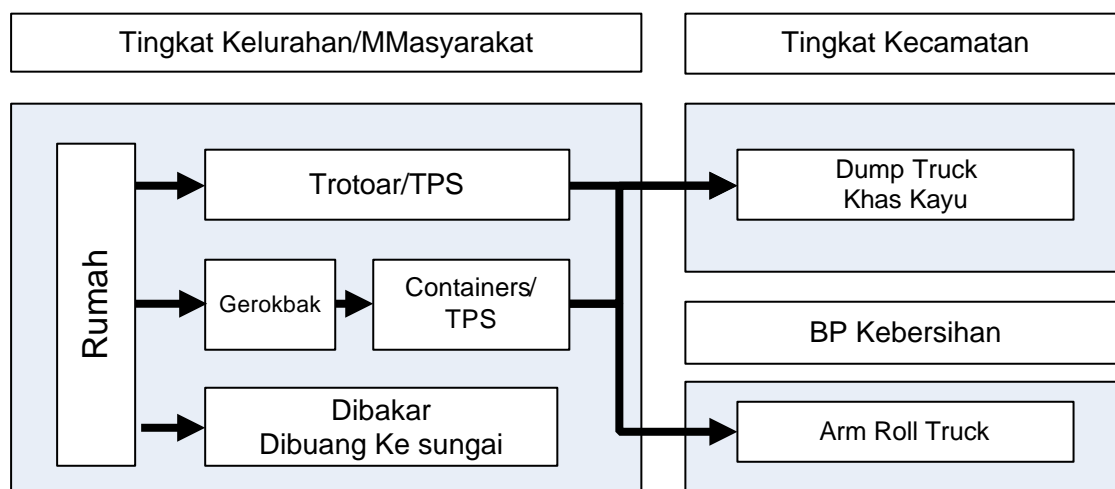
Timbulan sampah pada Kecamatan Malalayang sebesar 136.36 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 80.10 m<sup>3</sup>/hari dengan ritasi angkutan perhari 7.65 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Malalayang 56 orang yang terdiri atas 3 orang sopir, 21 orang krew kendaraan, 8 orang penyapu jalan dan 24 orang pendorong gerobak.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Wolter Monginsidi
2. Jalan Kampus Barat
3. Jalan Sam Ratu Langie
4. Jalan Santu Josep

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan sampah di trotoar dan atau memasukkannya ke TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun disebagian masyarakat ada yang pengumpulannya dilakukan dengan gerobak sampah dari rumah ke rumah dan dibawa ke TPS dan atau container berkoordinasi dengan kelurahan dan LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar dan dibuang ke sungai oleh masyarakat.



Dalam pengelolaan kebersihan di Kecamatan Malalayang untuk tahun 2003 telah dianggarkan dana sebesar Rp. 236.197.000,- melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003 (tidak termasuk ABT). Adapun komponen biaya tersebut meliputi :

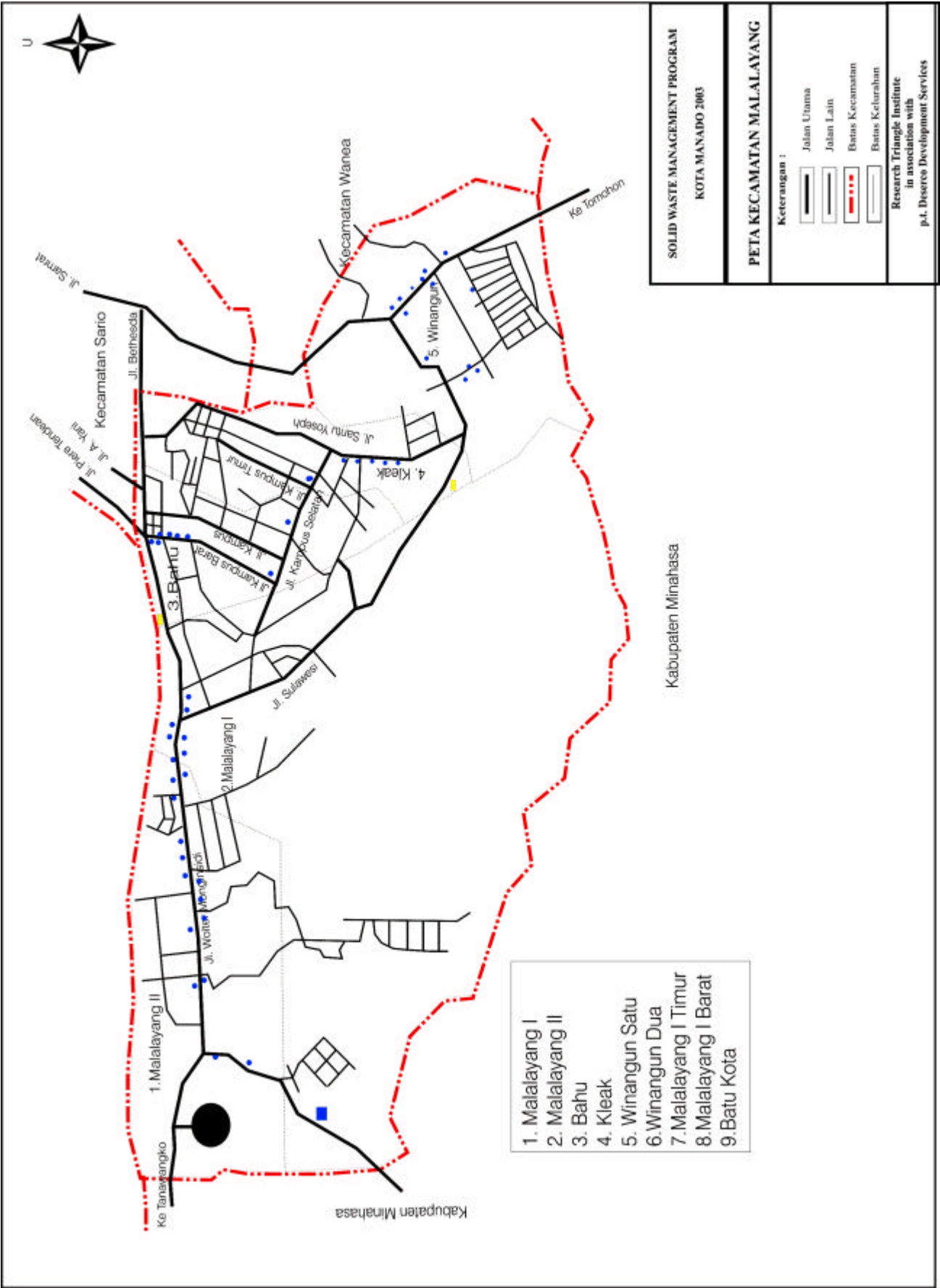
- |                                 |                              |
|---------------------------------|------------------------------|
| a. Administrasi Proyek          | : Rp. 3.170.000,- (1.34 %)   |
| b. Biaya operasional            | : Rp. 201.102.000,- (85.14%) |
| c. Biaya pemeliharaan kendaraan | : Rp. 31.925.000,- (13.52%)  |

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Malalayang secara fisik terletak pada posisi yang strategis karena merupakan pintu masuk dari Kabupaten Minahasa dan jalan penghubung utama trans Sulawesi. Kondisi topografi memiliki kemiringan yang bervariasi, untuk daerah yang relatif datar dengan kemiringan 0 – 8 % terdapat pada Kelurahan Bahu, Malalayang I, Malalayang I Timur dan sebagian dari Kelurahan Malalayang I Barat. Untuk daerah dengan kemiringan lahan lebih besar dari 15 % sebagian besar terdapat pada Kelurahan Kleak, Batu Kota, sebagian Malalayang I Barat, Winangun I dan Winangun II.

Dari dominasi fungsi terlihat bahwa sebagian besar merupakan lingkungan kawasan yang belum terbangun.

KECAMATAN MALAYLANG COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>106,687,400</b>	<b>218,434,500</b>	<b>(111,747,100)</b>	
<b>1 Salaries/Wages</b>	<b>86,753,900</b>	<b>192,435,000</b>	<b>(105,681,100)</b>	
<b>Project Administration</b>	<b>3,150,000</b>	<b>7,887,000</b>	<b>(4,737,000)</b>	
Project Leader	660,000	1,507,000		(11 x 137.000)
Treasurer	570,000	1,210,000		(11 x 110.000)
Administration Staff	420,000	770,000		(11 x 70.000)
Coordinator of supervisor	600,000	2,200,000		(11 x 200.000)
Supervisor	900,000	2,200,000		2(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>83,603,900</b>	<b>184,548,000</b>	<b>(100,944,100)</b>	
Driver	9,285,300	17,034,000		3(334x17.000)
Waste Transport	55,494,600	112,224,000		21(334x16.000)
Street sweeper	18,824,000	40,080,000		8(334x15.000)
Lebaran allowance	-	15,210,000		
Extra trips	-	-		
Health fund	-	-		
<b>2 Worktools</b>	-	-	-	
<b>3 Fuel</b>	<b>18,733,500</b>	<b>24,799,500</b>	<b>(6,066,000)</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	-	-	-	
Spare parts				
Inner tube/tire				
Oil				
Repair				
<b>5 Stationery</b>	<b>1,200,000</b>	<b>1,200,000</b>	-	
<b>6 Monitoring cost</b>	-	-	-	
<b>7 Other cost</b>	-	-	-	
<b>B MAINTENANCE COSTS</b>	<b>18,037,600</b>	<b>23,419,500</b>	<b>(5,381,900)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>275,000</b>	<b>275,000</b>	-	
Calculator	275,000	275,000		
Typewriter	-	-		
Camera	-	-		
Amplifier TOA	-	-		
<b>Total DIKDA (A+B+C)</b>	<b>125,000,000</b>	<b>242,129,000</b>	<b>(117,129,000)</b>	

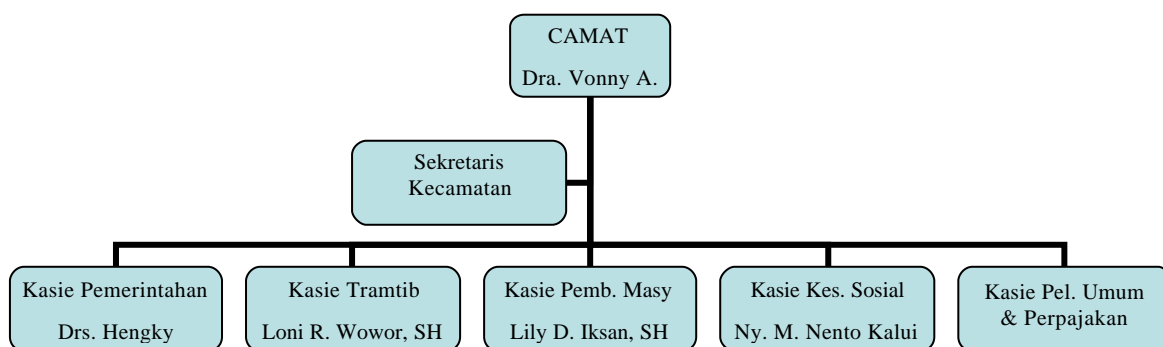


## PROFIL KECAMATAN MAPANGET

Kecamatan Mapanget terletak di pusat kota dengan luas 5922.2 ha.

Batas administratif :   Utara               Kabupaten Minahasa  
                                   Selatan       Kecamatan Tikala dan Kecamatan Singkil  
                                   Timur        Kabupaten Minahasa  
                                   Barat        Kecamatan Bunaken dan Kecamatan Tuminting

Jumlah Penduduk Kecamatan Mapanget pada Tahun 2003 adalah 49.500 jiwa dengan 11.728 KK dan tingkat kepadatan penduduk rata-rata 8.36 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Mapanget

Kecamatan Mapanget terdiri atas 9 Kelurahan yang meliputi :

1. Pandu
2. Kima Atas
3. Bengkol
4. Mapanget Barat
5. Lapangan
6. Buha
7. Paniki Bawah
8. Kairagi I
9. Kairagi II

Sarana dan prasarana pengelolaan persampahan di kecamatan Mapanget meliputi :

- |                    |           |
|--------------------|-----------|
| a. Dump Truck      | : - unit  |
| b. Truck Khas Kayu | : 1 unit  |
| c. Gerobak sampah  | : 27 unit |
| d. Container       | : 1 unit  |
| e. TPS             | : 28 unit |
| f. Titik Sampah    | : 28 buah |

Timbulan sampah pada Kecamatan Mapanget sebesar 123.75 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 16.18 m<sup>3</sup>/hari dengan ritasi angkutan perhari 2 rit untuk seluruh pelayanan angkutan sampah.

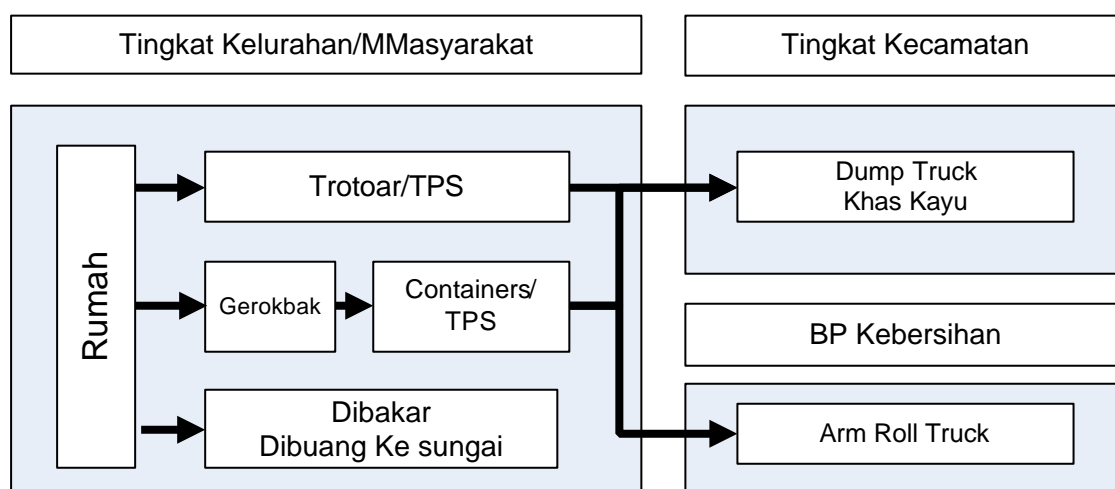
Tenaga kerja kebersihan pada Kecamatan Mapanget 45 orang yang terdiri atas 1 orang sopir, 10 orang krew kendaraan, 7 orang penyapu jalan dan 27 orang pendorong gerobak.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan MR. AA. Maramis
2. Jalan Belibis (arah Politeknik)
3. Jalan Mapanget Wusa

Dari sembilan kelurahan yang ada di Kecamatan Mapanget, terdapat 3 kelurahan yang belum tersentuh pelayanan angkutan sampah yaitu Kelurahan Pandu, Kelurahan Bengkol dan Kelurahan Kima Atas.

Metode pengumpulan sampah untuk beberapa kelurahan dengan membuang sampah ke TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun disebagian masyarakat ada yang pengumpulannya dilakukan dengan gerobak sampah dari rumah ke rumah dan dibawa ke TPS dan atau container berkoordinasi dengan kelurahan dan LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar, khususnya untuk warga yang belum terlayani angkutan sampah.



Dalam pengelolaan kebersihan di Kecamatan Mapanget untuk tahun 2003 telah dianggarkan dana sebesar Rp. 129.403.000,- (tidak termasuk ABT) melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003. Adapun komponen biaya tersebut meliputi :

1. Administrasi Proyek : Rp.2.500.000,- (1.93%)
2. Biaya operasional : Rp.120.488.000,- (93.11%)
3. Biaya pemeliharaan kendaraan : Rp.6.415.000,- (4.96%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Secara umum kondisi topografi Kecamatan Mapanget relatif datar dengan kemiringan lahan 0-8% dan mulai dilakukan pengembangan kawasan perumahan, pelayanan persampahan sebagian besar dilakukan di daerah perumahan.

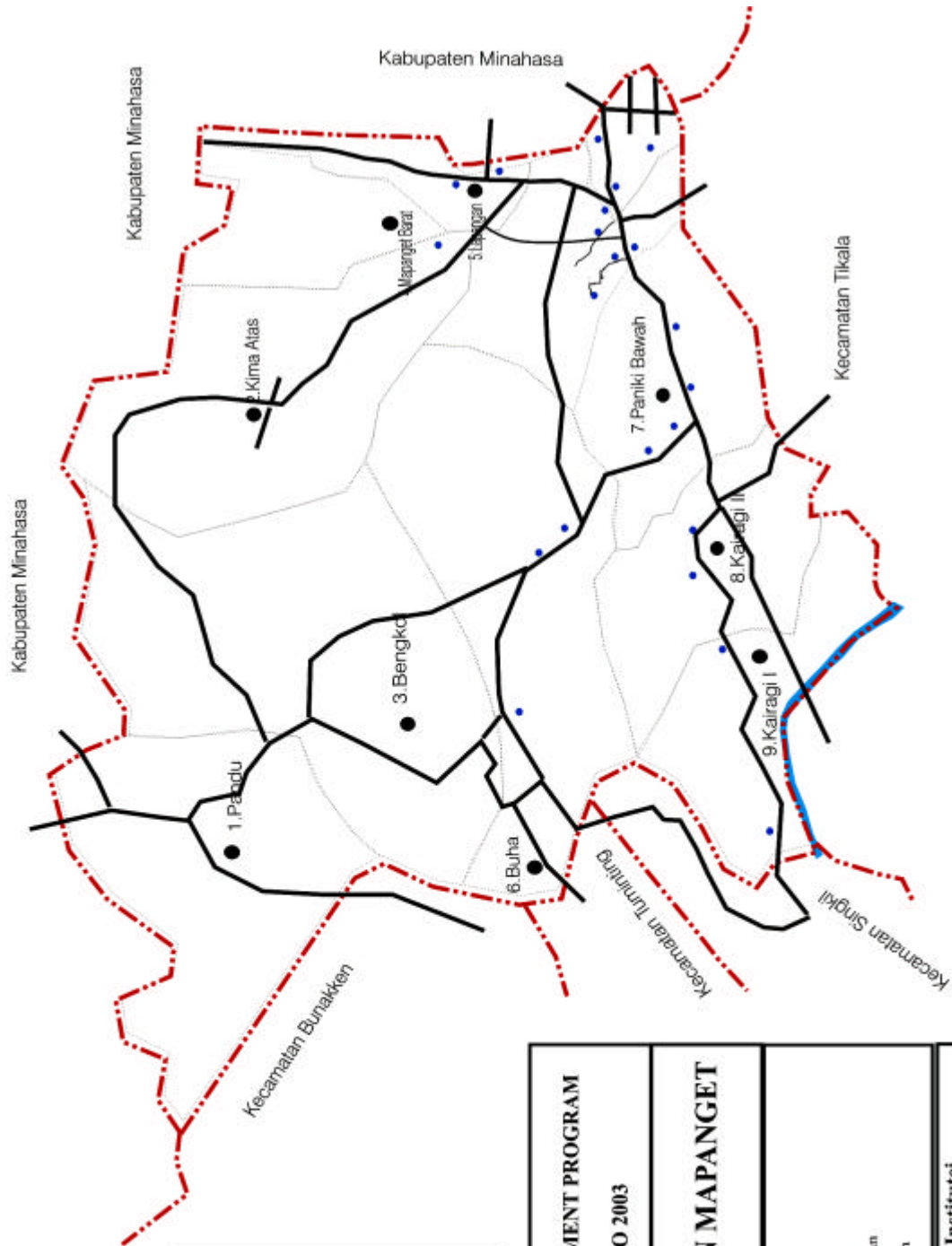


KECAMATAN MAPANGET				
COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>80,485,500</b>	<b>130,880,000</b>	<b>(50,394,500)</b>	
<b>1 Salaries/Wages</b>	<b>59,015,000</b>	<b>118,469,000</b>	<b>(59,454,000)</b>	
<b>Project Administration</b>	<b>3,150,000</b>	<b>7,887,000</b>	<b>(4,737,000)</b>	
Project Leader	660,000	1,507,000		(11 x 137.000)
Treasurer	570,000	1,210,000		(11 x 110.000)
Adminitration Staff	420,000	770,000		(11 x 70.000)
Coordinator of supervisor	600,000	2,200,000		(11 x 200.000)
Supervisor	900,000	2,200,000		2(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>55,865,000</b>	<b>110,582,000</b>	<b>(54,717,000)</b>	
Driver	6,154,000	11,356,000		2(334x17.000)
Waste Transport	28,960,000	53,440,000		10(334x16.000)
Street sweeper	19,005,000	35,070,000		7(334x15.000)
Lebaran allowance	-	8,970,000		
Extra trips	1,746,000	1,746,000		
Health fund	-	-		
<b>2 Worktools</b>	-	-	-	
<b>3 Fuel</b>	<b>14,570,500</b>	<b>5,511,000</b>	<b>9,059,500</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>4,600,000</b>	<b>4,600,000</b>	-	
Spare parts	850,000			
Inner tube/tire	3,390,000			
Oil	360,000			
Repair				
<b>5 Stationery</b>	<b>1,200,000</b>	<b>1,200,000</b>	-	
<b>6 Monitoring cost</b>	-	-	-	
<b>7 Other cost</b>	<b>1,100,000</b>	<b>1,100,000</b>	-	
<b>B MAINTENANCE COSTS</b>	<b>4,889,500</b>	<b>7,806,500</b>	<b>(2,917,000)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>4,625,000</b>	<b>4,625,000</b>	-	
Calculator	275,000			
Typewriter	2,000,000			
Camera	600,000			
Amplifier TOA	1,750,000			
<b>Total DIKDA (A+B+C)</b>	<b>90,000,000</b>	<b>143,311,500</b>	<b>(53,311,500)</b>	

# KECAMATAN MAPANGET



1. Pandu
2. Kima Atas
3. Bengkol
4. Mapanget Barat
5. Lapangan
6. Buha
7. Paniki Bawah
8. Kairagi II
9. Kairagi I



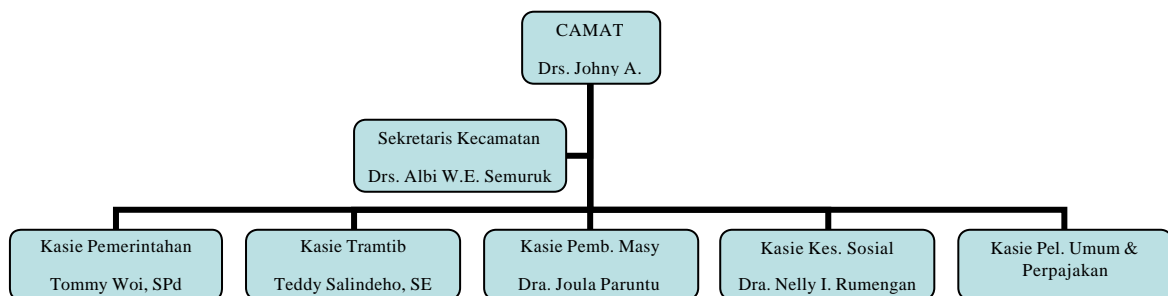
SOLID WASTE MANAGEMENT PROGRAM	
KOTA MANADO 2003	
PETA KECAMATAN MAPANGET	
Keterangan :	
	Jalan Utama
	Jalan Lain
	Batas Kecamatan
	Batas Kelurahan
Research Triangel Institutel in association with p.t. Deserco Development Services	

## PROFIL KECAMATAN SARIO

Kecamatan Sario terletak di pusat kota dengan luas 144.80 ha.

Batas administratif :   Utara               Kecamatan Wenang  
                                   Selatan        Kecamatan Malalayang  
                                   Timur          Kecamatan Wanea  
                                   Barat         Teluk Manado

Jumlah Penduduk Kecamatan Sario pada Tahun 2003 adalah 26.649 jiwa dengan 6.196 KK dan tingkat kepadatan penduduk rata-rata 184.04 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Sario

Kecamatan Sario terdiri atas 7 Kelurahan yang meliputi :

1. Titiwungen Utara
2. Titiwungen Selatan
3. Sario Utara
4. Sario Tumpaan
5. Sario
6. Sario Kotabaru
7. Ranotana

Sarana dan prasarana pengelolaan persampahan di kecamatan Sario meliputi :

- |                    |           |
|--------------------|-----------|
| a. Dump Truck      | : 1 unit  |
| b. Truck Khas Kayu | : 2 unit  |
| c. Gerobak sampah  | : 54 unit |
| d. Container       | : 2 unit  |
| e. TPS             | : 18 unit |
| f. Titik Sampah    | : 37 buah |

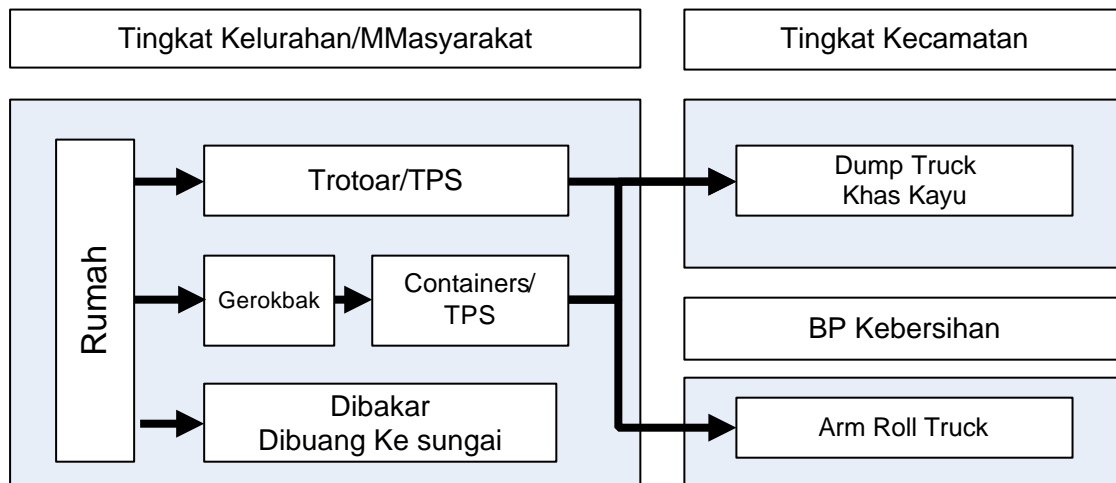
Timbulan sampah pada Kecamatan Sario sebesar 66.62 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 63.83 m<sup>3</sup>/hari dengan ritasi angkutan perhari 5.85 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Sario 41 orang yang terdiri atas 3 orang sopir, 20 orang krew kendaraan, 18 orang penyapu jalan.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Piere Tandean
2. Jalan A. Yani
3. Jalan Bathesda
4. Jalan Sam Ratulangie
5. Jalan Pramuka

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan sampah di trotoar dan atau memasukkannya ke TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun disebagian masyarakat ada yang pengumpulannya dilakukan dengan gerobak sampah dari rumah ke rumah dan dibawa ke TPS dan atau container berkoordinasi dengan kelurahan dan LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar dan dibuang ke sungai oleh masyarakat.



Dalam pengelolaan kebersihan di Kecamatan Sario untuk tahun 2003 telah dianggarkan dana sebesar Rp. , - (tidak termasuk ABT) melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003. Adapun komponen biaya tersebut meliputi :

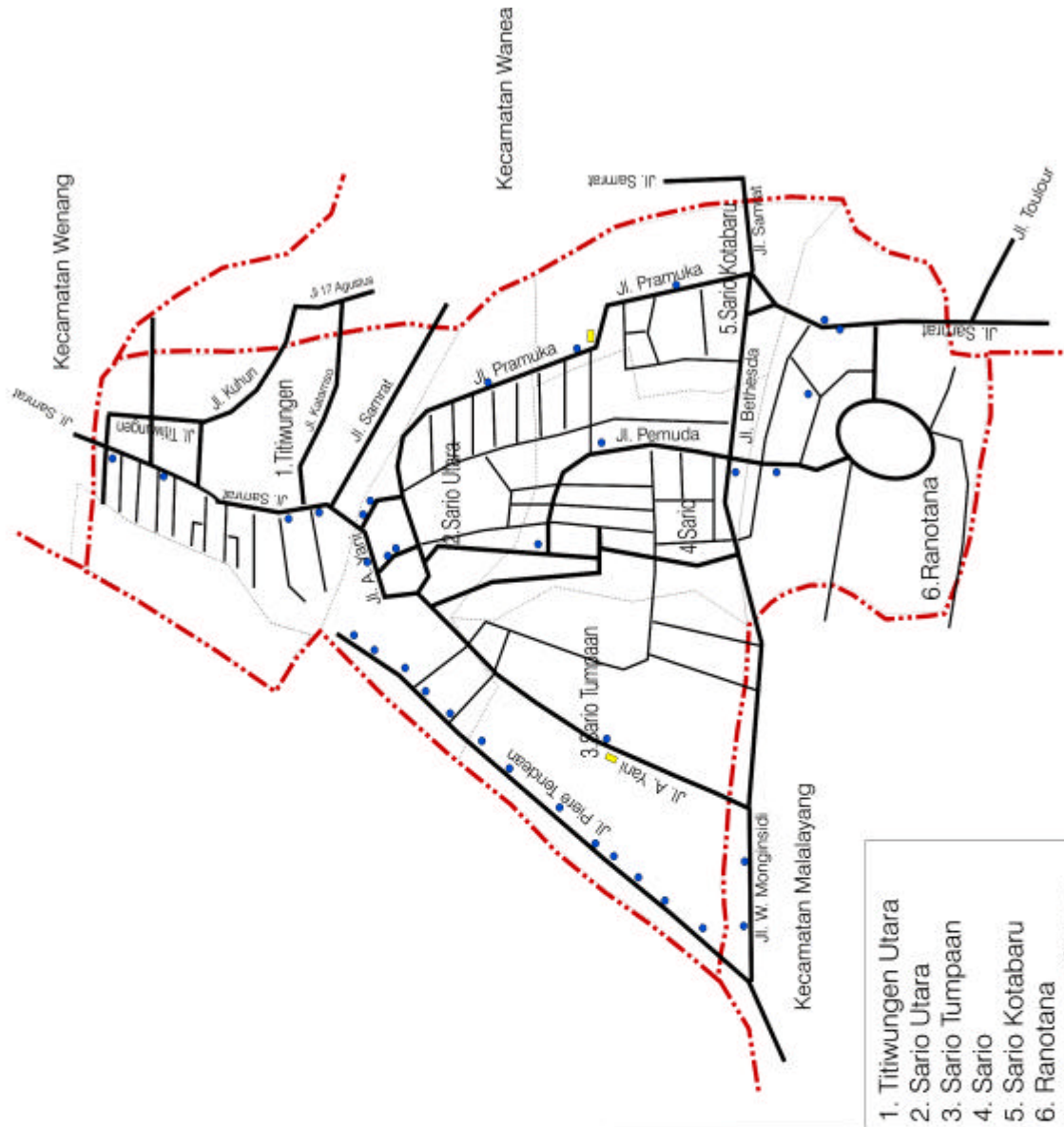
1. Administrasi Proyek : Rp. 3,170,000 - (1.11%)
2. Biaya operasional : Rp. 251,160,000 - (87.76%)
3. Biaya pemeliharaan kendaraan : Rp. 31,869,000 - (11.13%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Sario secara fisik dilewati oleh sungai Sario, dimana sungai tersebut melintasi wilayah permukiman penduduk Kelurahan Sario Utara, Kelurahan Titiwungen Utara dan Kelurahan Titiwungen Selatan. Kondisi topografi memiliki kemiringan yang relatif datar dengan kemiringan 0 – 5 %.

KECAMATAN SARIO				
COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>159,071,500</b>	<b>268,559,500</b>	<b>(109,488,000)</b>	
<b>1 Salaries/Wages</b>	<b>133,209,000</b>	<b>247,371,000</b>	<b>(114,162,000)</b>	
<b>Project Administration</b>	<b>4,200,000</b>	<b>6,787,000</b>	<b>(2,587,000)</b>	
Project Leader	770,000	1,507,000		(11 x 137.000)
Treasurer	665,000	1,210,000		(11 x 110.000)
Adminitration Staff	490,000	770,000		(11 x 70.000)
Coordinator of supervisor	700,000	1,100,000		(11 x 100.000)
Supervisor	1,575,000	2,200,000		1(11 x 200.000)
<b>Daily Temporary Laborer</b>	<b>129,009,000</b>	<b>240,584,000</b>	<b>(111,575,000)</b>	
Driver	10,863,000	17,034,000		3(334x17.000)
Waste Transport	57,936,000	106,880,000		20(334x16.000)
Street sweeper	57,510,000	95,190,000		19(334x15.000)
Lebaran allowance	-	19,680,000		
Extra trips	2,700,000	1,800,000		
Health fund	-	-		
<b>2 Worktools</b>			-	
<b>3 Fuel</b>	<b>23,962,500</b>	<b>19,288,500</b>	<b>4,674,000</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	-	-	-	
Spare parts				
Inner tube/tire				
Oil				
Repair				
<b>5 Stationery</b>	<b>1,200,000</b>	<b>1,200,000</b>	-	
<b>6 Monitoring cost</b>				
<b>7 Other cost</b>	700,000	700,000		
<b>B MAINTENANCE COSTS</b>	<b>15,928,500</b>	<b>24,332,000</b>	<b>(8,403,500)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	-	-	-	
Calculator				
Typewriter				
Camera				
Amplifier TOA				
<b>Total DIKDA (A+B+C)</b>	<b>175,000,000</b>	<b>292,891,500</b>	<b>(117,891,500)</b>	

# KECAMATANAN SARIO



1. Titiwungen Utara
2. Sario Utara
3. Sario Tumpaan
4. Sario
5. Sario Kotabaru
6. Ranotana
7. Titiwungen Selatan

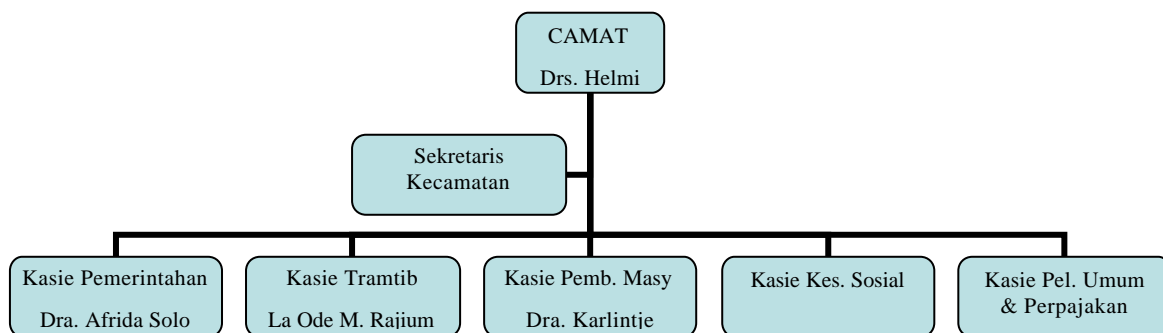
SOLID WASTE MANAGEMENT PROGRAM KOTA MANADO 2003	
PETA KECAMATAN SARIO	
Keterangan :	
	Jalan Utama
	Jalan Lain
	Batas Kecamatan
	Batas Kelurahan
Research Triangle Institute in association with p.t. Deservo Development Services	

## PROFIL KECAMATAN SINGKIL

Kecamatan Singkil terletak di pusat kota dengan luas 389.10 ha.

Batas administratif :   Utara               Kecamatan Tuminting  
                                   Selatan       Kecamatan Tikala dan Kecamatan Wenang  
                                   Timur        Kecamatan Mapanget  
                                   Barat       Teluk Manado

Jumlah Penduduk Kecamatan Singkil pada Tahun 2003 adalah 46.865 jiwa dengan 10.051 KK dan tingkat kepadatan penduduk rata-rata 120.44 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Singkil

Kecamatan Singkil terdiri atas 9 Kelurahan yang meliputi :

1. Singkil Satu
2. Singkil Dua
3. Kombos Barat
4. Kombos Timur
5. Ternate Baru
6. Karame
7. Ketang Baru
8. Wawonasa
9. Ternate Tanjung

Sarana dan prasarana pengelolaan persampahan di kecamatan Singkil meliputi :

- |                    |           |
|--------------------|-----------|
| a. Dump Truck      | : 1 unit  |
| b. Truck Khas Kayu | : - unit  |
| c. Gerobak sampah  | : - unit  |
| d. Container       | : 2 unit  |
| e. TPS             | : 28 unit |
| f. Titik Sampah    | : 28 buah |

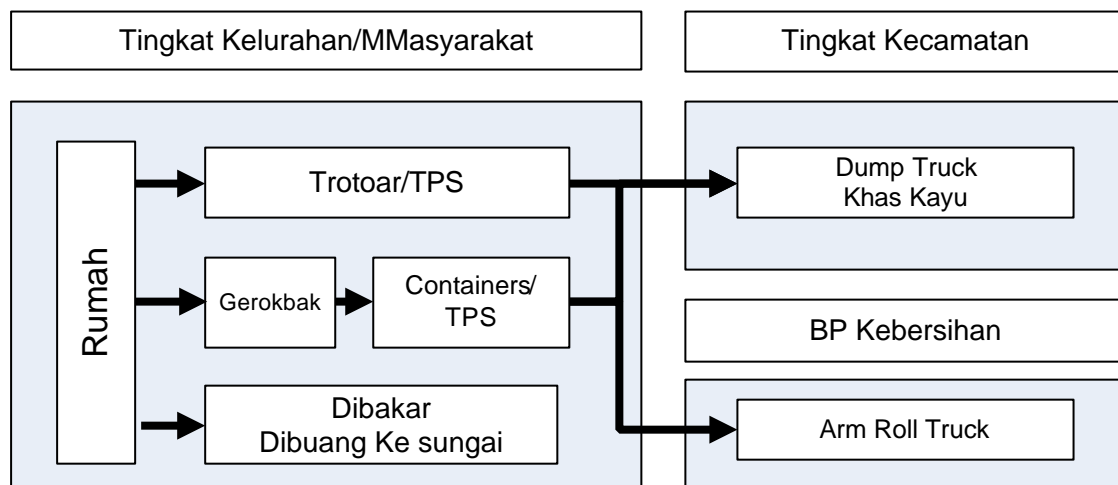
Timbulan sampah pada Kecamatan Singkil sebesar 117.16 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 31.58 m<sup>3</sup>/hari dengan ritasi angkutan perhari 4 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Singkil 15 orang yang terdiri atas 2 orang sopir, 10 orang krew kendaraan dan 3 orang penyapu jalan.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Ari Lasut
2. Jalan Sungai Musi
3. Jalan Bengawan Solo

Metode pengumpulan sampah untuk beberapa kelurahan dengan membuang sampah ke trotoar/TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar.



Dalam pengelolaan kebersihan di Kecamatan Singkil untuk tahun 2003 telah dianggarkan dana sebesar Rp. 134.231.000,- melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003 (belum termasuk ABT). Adapun komponen biaya tersebut meliputi :

1. Administrasi Proyek : Rp.2.750.000,- (2.05%)
2. Biaya operasional : Rp.114.231.000,- (83.05%)
3. Biaya pemeliharaan kendaraan : Rp.20.000.000,- (14.90%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Singkil secara fisik dilewati oleh sungai Maasing dan sungai Tondano pada bagian selatan. Untuk kawasan disepanjang sungai Tondano ditetapkan sebagai daerah rawan banjir yang tergolong berbahaya sehingga daerah sempadan sungai dengan lebar 15 m sebagai daerah bebas bangunan. Kondisi topografi Kecamatan Singkil relative bergelombang dengan kemiringan berkisar antara 0-8% pada daerah terbangun disebelah selatan dan daerah perbukitan dengan kemiringan berkisar 0-50% terdapat disebelah utara.



KECAMATAN SINGKIL				
COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>94,077,600</b>	<b>106,505,000</b>	<b>(12,427,400)</b>	
<b>1 Salaries/Wages</b>	<b>71,667,600</b>	<b>94,283,000</b>	<b>(22,615,400)</b>	
<b>Project Administration</b>	<b>5,250,000</b>	<b>7,887,000</b>	<b>(2,637,000)</b>	
Project Leader	1,100,000	1,507,000		(11 x 137.000)
Treasurer	950,000	1,210,000		(11 x 110.000)
Adminitration Staff	700,000	770,000		(11 x 70.000)
Coordinator of supervisor	1,000,000	2,200,000		(11 x 200.000)
Supervisor	1,500,000	2,200,000		2(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>66,417,600</b>	<b>86,396,000</b>	<b>(19,978,400)</b>	
Driver	10,362,600	11,356,000		2(334x17.000)
Waste Transport	44,238,000	53,440,000		10(334x16.000)
Street sweeper	11,817,000	15,030,000		3(334x15.000)
Lebaran allowance	-	6,570,000		
Extra trips	-	-		
Health fund	-	-		
<b>2 Worktools</b>	-	-	-	
<b>3 Fuel</b>	<b>21,210,000</b>	<b>11,022,000</b>	<b>10,188,000</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	-	-	-	
Spare parts	-			
Inner tube/tire	-			
Oil	-			
Repair				
<b>5 Stationery</b>	<b>1,200,000</b>	<b>1,200,000</b>	-	
<b>6 Monitoring cost</b>	-		-	
<b>7 Other cost</b>	-		-	
<b>B MAINTENANCE COSTS</b>	<b>3,647,400</b>	<b>17,438,000</b>	<b>(13,790,600)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>2,275,000</b>	<b>2,275,000</b>	-	
Calculator	275,000			
Typewriter	2,000,000			
Camera	-			
Amplifier TOA	-			
<b>Total DIKDA (A+B+C)</b>	<b>100,000,000</b>	<b>126,218,000</b>	<b>(26,218,000)</b>	

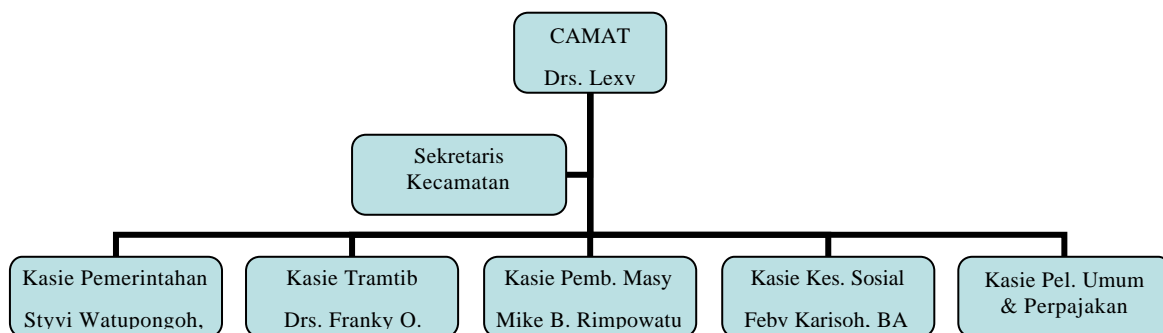


## PROFIL KECAMATAN TIKALA

Kecamatan Tikala terletak di sebelah timur pusat kota dengan luas 1.681,06 ha.

Batas administratif :   Utara               Kecamatan Singkil dan Kecamatan Mapangget  
                                   Selatan        Kecamatan Wanea  
                                   Timur         Kabupaten Minahasa  
                                   Barat         Kecamatan Wenang

Jumlah Penduduk Kecamatan Tikala pada Tahun 2003 adalah 70.867 jiwa dengan 14.853 KK dan tingkat kepadatan penduduk rata-rata 42.16 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Tikala

Kecamatan Tikala terdiri atas 12 Kelurahan yang meliputi :

1. Kairagi Weru
2. Paal II
3. Dendengan Luar
4. Dendengan Dalam
5. Tikala Ares
6. Tikala Baru
7. Ranomuut
8. Banjer
9. Taas
10. Paal IV
11. Perkamil
12. Malendeng

Sarana dan prasarana pengelolaan persampahan di kecamatan Tikala meliputi :

- |                    |           |
|--------------------|-----------|
| a. Dump Truck      | : 2 unit  |
| b. Truck Khas Kayu | : 1 unit  |
| c. Gerobak sampah  | : 24 unit |
| d. Container       | : 1 unit  |
| e. TPS             | : 35 unit |
| f. Titik Sampah    | : 35 buah |

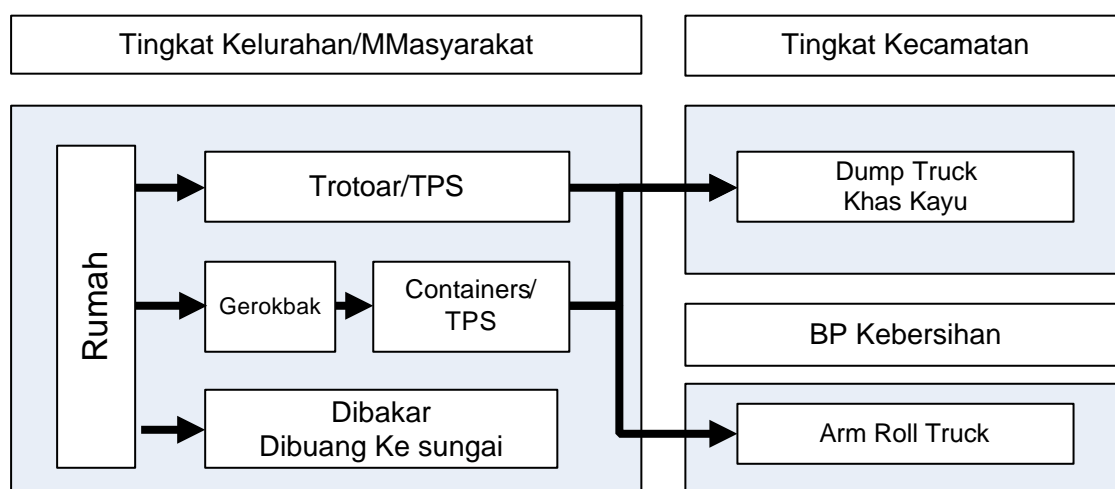
Timbulan sampah pada Kecamatan Tikala sebesar 177.17 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 62.32 m<sup>3</sup>/hari dengan ritasi angkutan perhari 7.24 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Tikala 55 orang yang terdiri atas 3 orang sopir, 16 orang krew kendaraan, 12 orang penyapu jalan dan 24 orang pendorong gerobak.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Yos Sudarso
2. Jalan Martadinata
3. Jalan Pingkan Matindas
4. Jalan Daan Mogot
5. Jalan Manguni
6. Jalan Pomorow

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan/membuang sampah ke trotoar/TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun ada sebagian masyarakat yang membuang sampah dengan menggunakan gerobak dan berkoordinasi dengan Kelurahan/LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar dan dibuang ke sungai.



Dalam pengelolaan kebersihan di Kecamatan Tikala untuk tahun 2003 telah dianggarkan dana sebesar Rp. 235.806.000,- melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003 (belum termasuk ABT). Adapun komponen biaya tersebut meliputi :

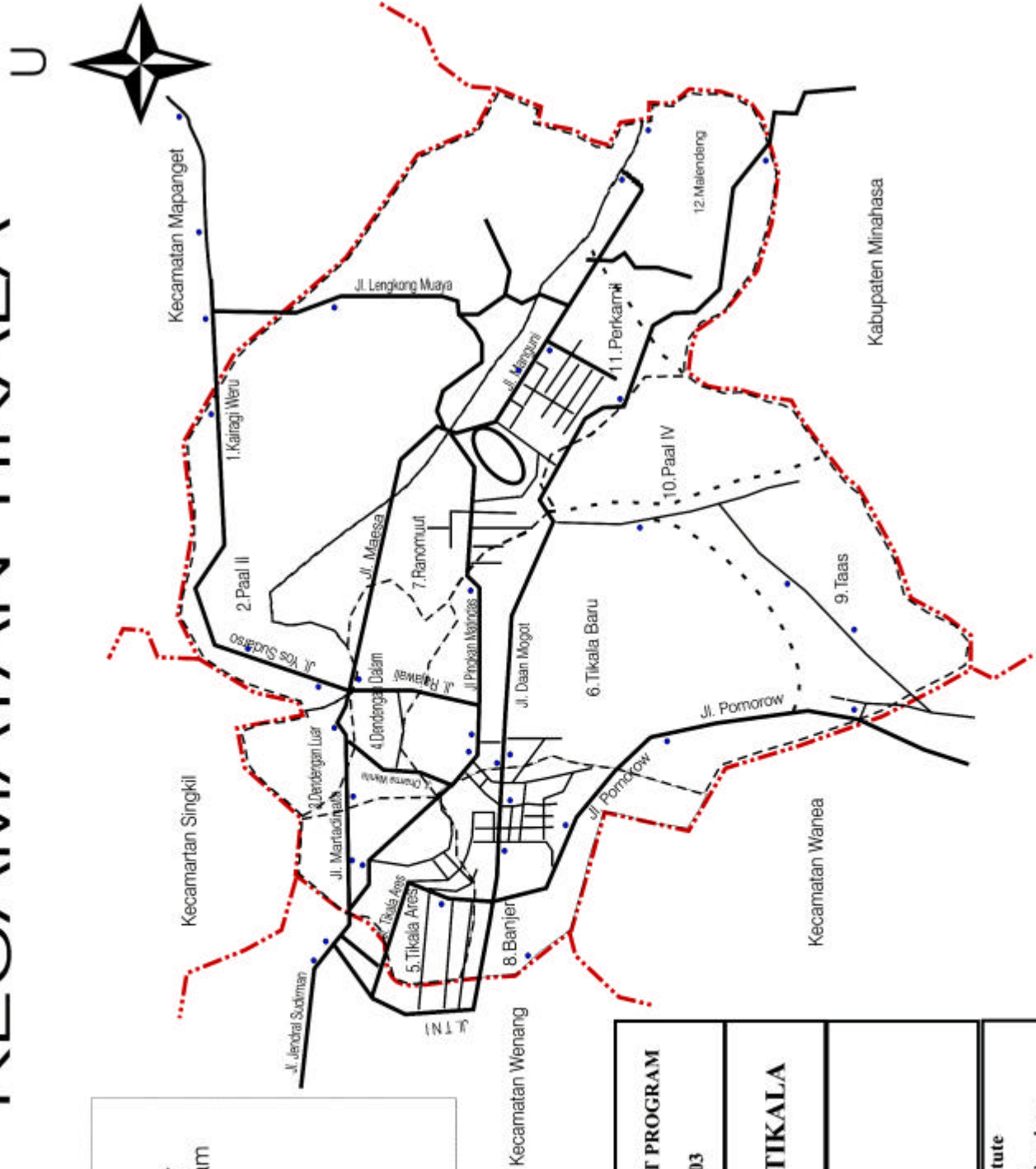
1. Administrasi Proyek : Rp.2.750.000,- (1.17%)
2. Biaya operasional : Rp.220.300.000,- (93.42%)
3. Biaya pemeliharaan kendaraan : Rp.12.756.000,- (5.41%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Tikala secara fisik dilewati oleh 3 sungai yaitu sungai Tikala, sungai Tingkulu dan sungai Tondano. Kondisi topografi memiliki kemiringan yang relatif datar dengan kemiringan <7%, namun sebagian kecil diselatan yang berbatasan dengan Kecamatan Wanea dan dibagian utara yang berbatasan dengan Kecamatan Mapanget cukup berbukit dengan kemiringan lahan 15-25%. Lingkungan terbangun tersebar secara merata diwilayah kecamatan Tikala bagian barat dan ke arah utara sedangkan kearah selatan masih merupakan kantong permukiman yang menyebar pada jalur jalan dan tanah landai, kondisi lingkungan terbangunnya berkisar 80%.

KECAMATAN TIKALA COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>167,118,500</b>	<b>241,537,000</b>	<b>(74,418,500)</b>	
<b>1 Salaries/Wages</b>	<b>110,996,000</b>	<b>182,935,000</b>	<b>(71,939,000)</b>	
<b>Project Administration</b>	<b>13,400,000</b>	<b>7,887,000</b>	<b>5,513,000</b>	
Project Leader	880,000	1,507,000		(11 x 137.000)
Treasurer	760,000	1,210,000		(11 x 110.000)
Administration Staff	560,000	770,000		(11 x 70.000)
Coordinator of supervisor	-	-		
Supervisor	11,200,000	4,400,000		4(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>97,596,000</b>	<b>175,048,000</b>	<b>(77,452,000)</b>	
Driver	12,312,000	17,034,000		3(334x17.000)
Waste Transport	56,064,000	85,504,000		16(334x16.000)
Street sweeper	18,720,000	50,100,000		10(334x15.000)
Lebaran allowance		11,910,000		
Extra trips	10,500,000	10,500,000		
Health fund	-			
<b>2 Worktools</b>			-	
<b>3 Fuel</b>	<b>22,320,000</b>	<b>24,799,500</b>	<b>(2,479,500)</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>18,900,000</b>	<b>18,900,000</b>	<b>-</b>	
Spare parts				
Inner tube/tire	18,900,000			
Oil				
Repair				
<b>5 Stationery</b>	<b>1,902,500</b>	<b>1,902,500</b>	<b>-</b>	
<b>6 Monitoring cost</b>	<b>12,000,000</b>	<b>12,000,000</b>	<b>-</b>	
<b>7 Other cost</b>	<b>1,000,000</b>	<b>1,000,000</b>	<b>-</b>	
<b>B MAINTENANCE COSTS</b>	<b>7,881,500</b>	<b>26,157,000</b>	<b>(18,275,500)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>-</b>	<b>-</b>	<b>-</b>	
Calculator				
Typewriter				
Camera				
Amplifier TOA				
<b>Total DIKDA (A+B+C)</b>	<b>175,000,000</b>	<b>267,694,000</b>	<b>(92,694,000)</b>	

# KECAMATANAN TIKALA



1. Kairagi Weru
2. Paal II
3. Dendengan Luar
4. Dendengan Dalam
5. Tikala Ares
6. Tikala Baru
7. Ranomuut
8. Banjar
9. Taas
10. Paal IV
11. Perkamil
12. Malendeng

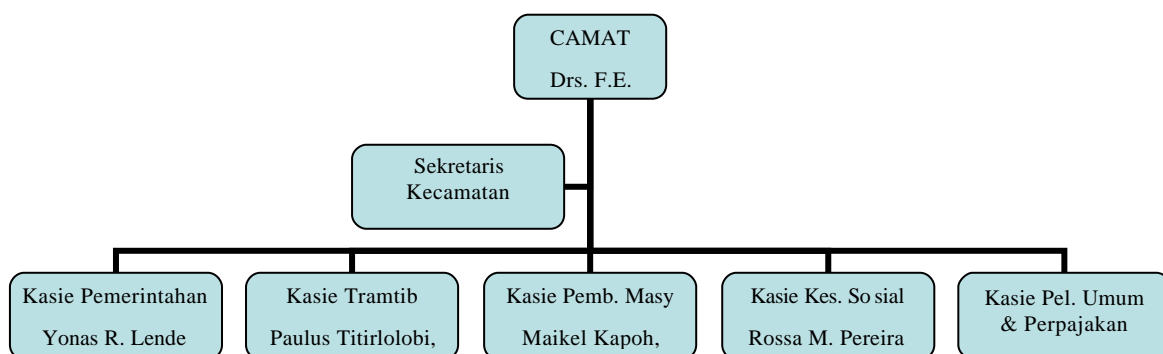
SOLID WASTE MANAGEMENT PROGRAM	
KOTA MANADO 2003	
PETA KECAMATAN TIKALA	
Keterangan :	
Jalan Utama	—
Jalan Lain	- - -
Batas Kecamatan	— . . . —
Batas Kelurahan	- - - -
Research Triangle Institute in association with p.t. Deserco Development Services	

## PROFIL KECAMATAN TUMINTING

Kecamatan Tuminting terletak di utara pusat kota dengan luas 489.2 ha.

Batas administratif :   Utara               Kecamatan Bunaken  
                                   Selatan        Kecamatan Wenang dan Kecamatan singkil  
                                   Timur          Kecamatan Mapanget  
                                   Barat          Teluk Manado

Jumlah Penduduk Kecamatan Tuminting pada Tahun 2003 adalah 49.648 jiwa dengan 10.951 KK dan tingkat kepadatan penduduk rata-rata 101,49 jiwa/ha.



Struktur Organisasi Kepemerintahan Kecamatan Tuminting

Kecamatan Tuminting terdiri atas 10 Kelurahan yang meliputi :

1. Tumumpa I
2. Tumumpa II
3. Maasing
4. Tuminting
5. Bitung Karang Ria
6. Sindulang I
7. Sindulang II
8. Kampung Islam
9. Mahawu
10. Sumompo

Sarana dan prasarana pengelolaan persampahan di kecamatan Tuminting meliputi :

- |                    |            |
|--------------------|------------|
| a. Dump Truck      | : - unit   |
| b. Truck Khas Kayu | : 1 unit   |
| c. Truck Khas Besi | : 1 unit   |
| d. Gerobak sampah  | : 10 unit  |
| e. Container       | : - unit   |
| f. TPS             | : 15 unit  |
| g. Titik Sampah    | : 33 buah  |
| h. TPA Sampah      | : 1 lokasi |



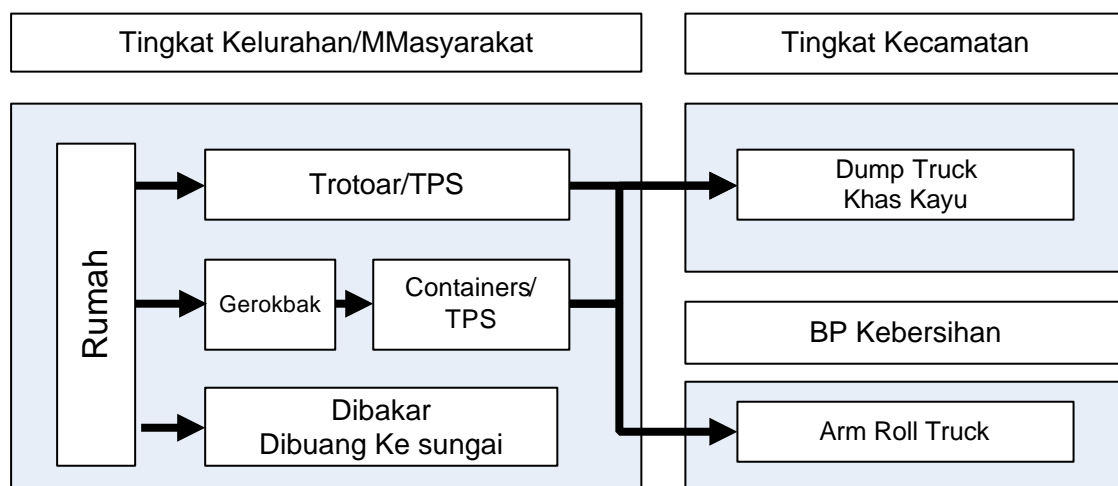
Timbulan sampah pada Kecamatan Tuminting sebesar 124.12 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 44.61 m<sup>3</sup>/hari dengan ritasi angkutan perhari 6 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Tuminting 27 orang yang terdiri atas 2 orang sopir, 12 orang krew kendaraan, 3 orang penyapu jalan dan 10 orang pendorong gerobak.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Hasanudin
2. Jalan Pongidon

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan/ membuang sampah ke trotoar/TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun ada sebagian masyarakat yang membuang sampah dengan menggunakan gerobak dan berkoordinasi dengan Kelurahan/LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar dan dibuang ke sungai.



Dalam pengelolaan kebersihan di Kecamatan Tuminting untuk tahun 2003 telah dianggarkan dana sebesar Rp. 139.530.000,- melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003 (belum termasuk ABT). Adapun komponen biaya tersebut meliputi :

1. Administrasi Proyek : Rp.4.750.000,- (3.40%)
2. Biaya operasional : Rp.119.725.000,- (85.81%)
3. Biaya pemeliharaan kendaraan : Rp.15.055.000,- (10.79%)

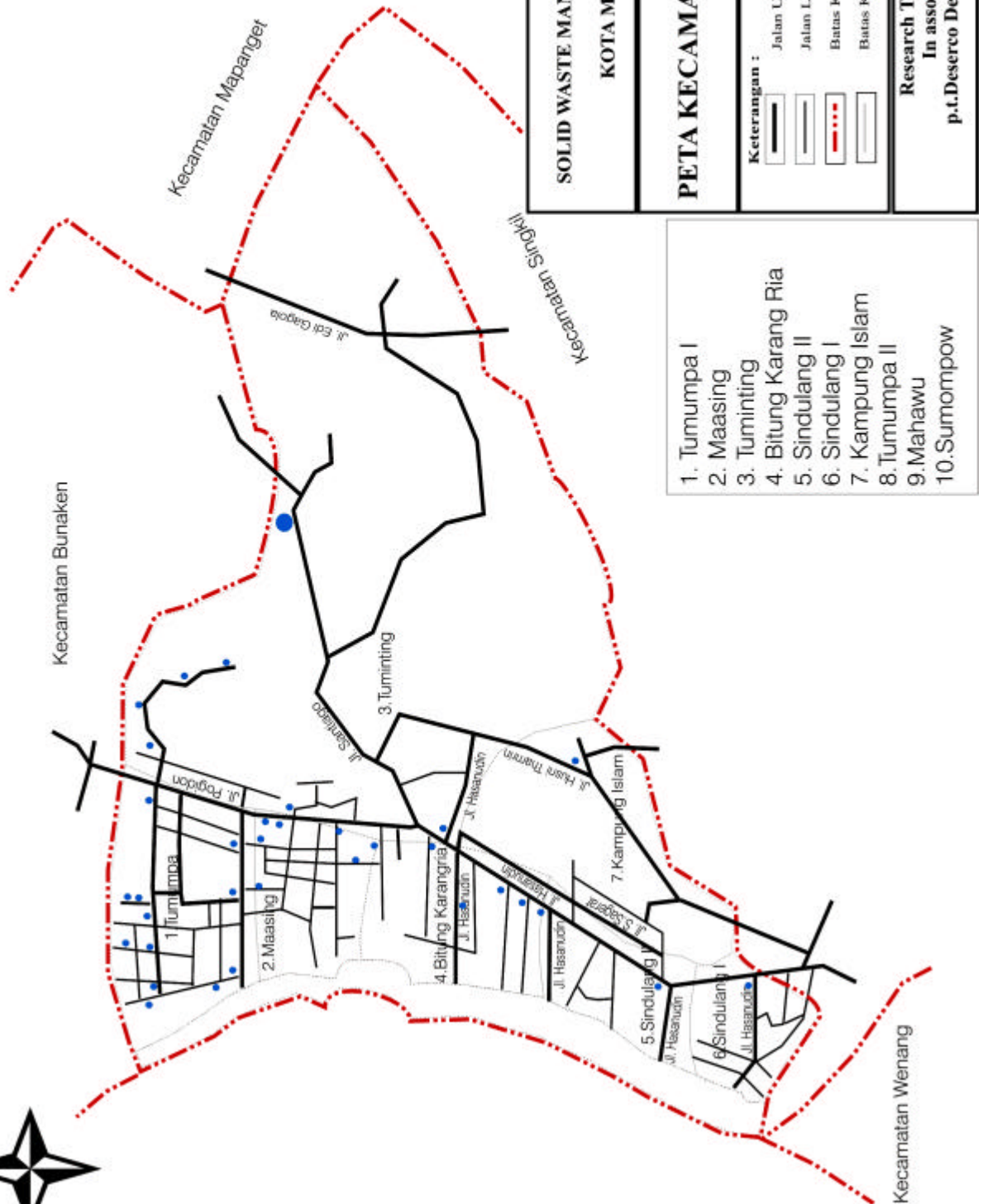
Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Tuminting secara fisik dibelah menjadi dua bagian oleh sungai Bailang dan dibagian utara terdapat sungai kecil Paniki. Kondisi topografi kecamatan Tuminting cenderung landai dengan kemiringan lereng <15% dan kawasannya



berfungsi sebagai lingkungan terbangun dengan kegiatan utamanya adalah permukiman dan perdagangan.

KECAMATAN TUMINTING COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>153,214,000</b>	<b>135,558,500</b>	17,655,500	
<b>1 Salaries/Wages</b>	<b>104,709,000</b>	<b>104,171,000</b>	538,000	
<b>Project Administration</b>	<b>8,525,000</b>	<b>8,987,000</b>	(462,000)	
Project Leader	1,210,000	1,507,000		(11 x 137.000)
Treasurer	1,045,000	1,210,000		(11 x 110.000)
Administration Staff	770,000	770,000		(11 x 70.000)
Coordinator of supervisor	2,200,000	2,200,000		(11 x 200.000)
Supervisor	3,300,000	3,300,000		3(11 x 100.000)
<b>Daily Temporary Laborer</b>	<b>96,184,000</b>	<b>95,184,000</b>	1,000,000	
Driver	11,356,000	11,356,000		2(334x17.000)
Waste Transport	64,128,000	64,128,000		12(334x16.000)
Street sweeper	10,020,000	10,020,000		2(334x15.000)
Lebaran allowance	7,680,000	7,680,000		
Extra trips	2,000,000	2,000,000		
Health fund	1,000,000	-		
<b>2 Worktools</b>	<b>6,240,000</b>	<b>6,240,000</b>	-	
<b>3 Fuel</b>	<b>30,895,000</b>	<b>13,777,500</b>	17,117,500	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>9,720,000</b>	<b>9,720,000</b>	-	
Spare parts				
Inner tube/tire	7,200,000			
Oil	2,520,000			
Repair				
<b>5 Stationery</b>	<b>1,650,000</b>	<b>1,650,000</b>	-	
<b>6 Monitoring cost</b>	-	-	-	
<b>7 Other cost</b>	-	-	-	
<b>B MAINTENANCE COSTS</b>	<b>6,786,000</b>	<b>25,244,500</b>	(18,458,500)	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	-	-	-	
Calculator				
Typewriter				
Camera				
Amplifier TOA				
<b>Total DIKDA (A+B+C)</b>	<b>160,000,000</b>	<b>160,803,000</b>	<b>(803,000)</b>	

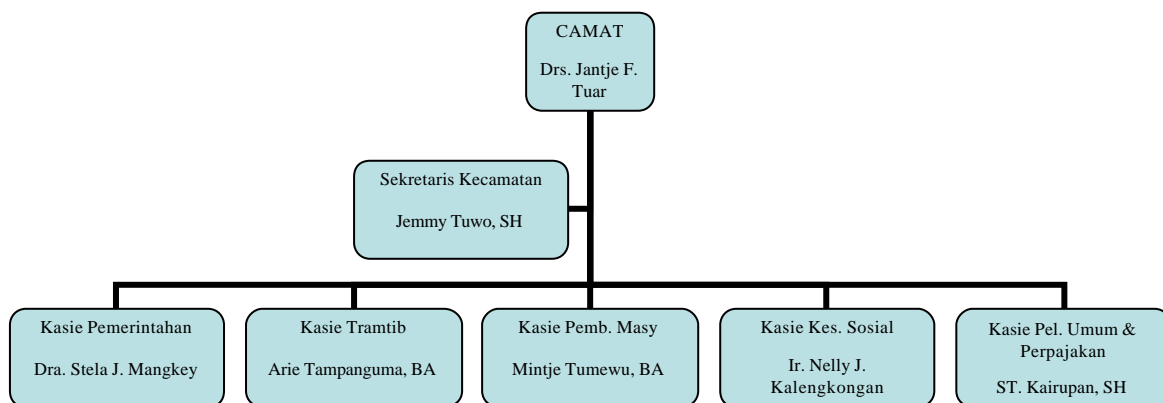


## PROFIL KECAMATAN WANEA

Kecamatan Wanea terletak di sebelah timur pusat kota dengan luas 660.35 ha.

Batas administratif :   Utara               Kecamatan Wenang dan Kecamatan Tikala  
                                   Selatan        Kecamatan Malalayang dan Kabupaten Minahasa  
                                   Timur         Kecamatan Tikala  
                                   Barat         Kecamatan Sario

Jumlah Penduduk Kecamatan Wanea pada Tahun 2003 adalah 58.367 jiwa dengan 11.931 KK dan tingkat kepadatan penduduk rata-rata 88.39 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Wanea

Kecamatan Wanea terdiri atas 9 Kelurahan yang meliputi :

1. Teling Atas
2. Tanjung Batu
3. Wanea
4. Pakowa
5. Karombasan Utara
6. Karombasan selatan
7. Ranotana Weru
8. Bumi Nyiur
9. Tingkulu

Sarana dan prasarana pengelolaan persampahan di kecamatan Wanea meliputi :

- |                    |                                |
|--------------------|--------------------------------|
| a. Dump Truck      | : 2 unit                       |
| b. Truck Khas Kayu | : 1 unit                       |
| c. Gerobak sampah  | : 27 unit                      |
| d. Container       | : 2 unit                       |
| e. TPS             | : 44 unit                      |
| f. Titik Sampah    | : 44 buah                      |
| g. TPA             | : 2 lokasi (Taas dan Tingkulu) |

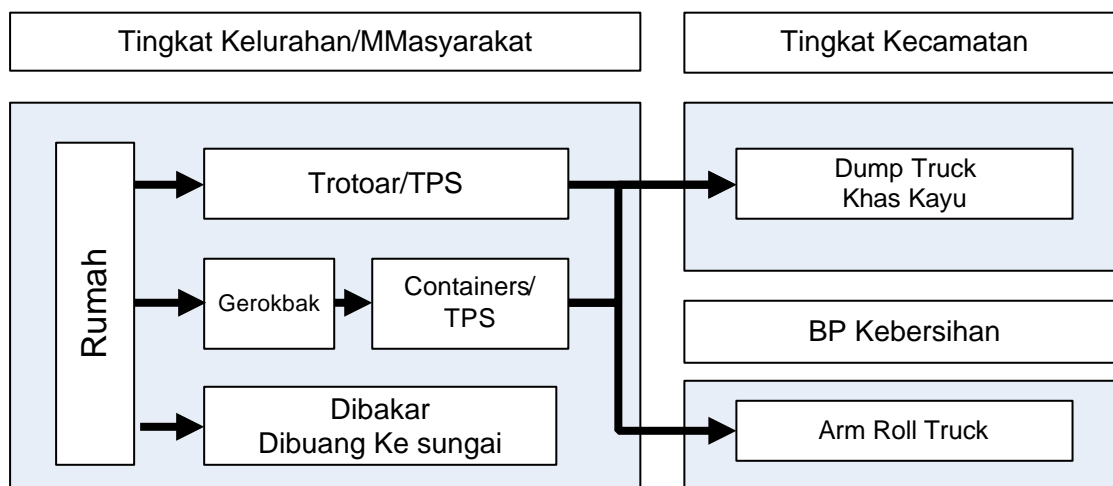
Timbulan sampah pada Kecamatan Wanea sebesar 145.92 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) sedangkan jumlah sampah terangkut sebesar 63.81 m<sup>3</sup>/hari dengan ritasi angkutan perhari 6.41 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Wanea 56 orang yang terdiri atas 3 orang sopir, 16 orang krew kendaraan, 17 orang penyapu jalan dan 20 orang pendorong gerobak.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Tololiu Supit
2. Jalan Sam Ratulangi
3. Jalan Babe Palar
4. Jalan Arnold Mononutu
5. Jalan Tolour
6. Jalan 17 Agustus

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan sampah di trotoar dan atau memasukkannya ke TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun disebagian masyarakat ada yang pengumpulannya dilakukan dengan gerobak sampah dari rumah ke rumah dan dibawa ke TPS dan atau container berkoordinasi dengan kelurahan dan LPM. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian sampah ada yang dibakar dan dibuang ke sungai oleh masyarakat.



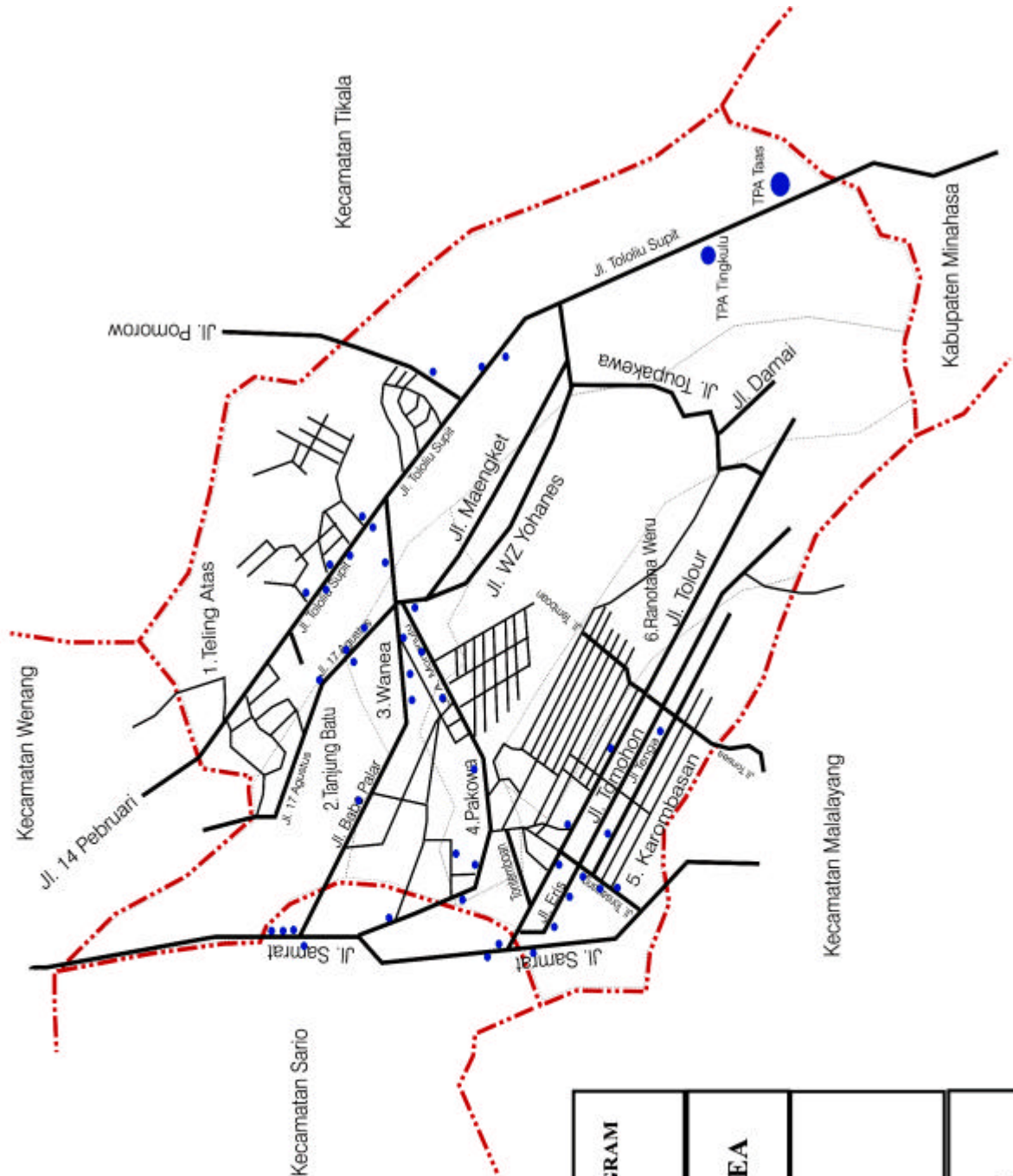
Dalam pengelolaan kebersihan di Kecamatan Wanea untuk tahun 2003 telah dianggarkan dana sebesar Rp. 274.647.000,- (tidak termasuk ABT) melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003. Adapun komponen biaya tersebut meliputi :

1. Administrasi Proyek : Rp. 3.170.000,- (1.15 %)
2. Biaya operasional : Rp. 243.682.000,- (88.73%)
3. Biaya pemeliharaan kendaraan : Rp. 27.795.000,- (10.12%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Wanea secara fisik dilewati oleh 4 sungai yaitu sungai Wanea, sungai Sario, sungai Ranotana dan sungai Kumaraka, yang mana sungai-sungai tersebut pada umumnya melintasi wilayah permukiman penduduk dan daerah perkebunan. . Kondisi topografi memiliki kemiringan yang bervariasi, untuk daerah yang relative datar dengan kemiringan 0 – 5 % terdapat pada daerah tengah, bagian barat dan sebagian daerah utara. Untuk daerah bagian timur dan selatan serta sebagian daerah utara memiliki kemiringan bervariasi berkisar 0 – 15 % dan 5 – 50 %..

KECAMATAN WANEA				
COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>169,049,000</b>	<b>241,133,500</b>	<b>(72,084,500)</b>	
<b>1 Salaries/Wages</b>	<b>125,229,000</b>	<b>201,875,000</b>	<b>(76,646,000)</b>	
<b>Project Administration</b>	<b>13,125,000</b>	<b>11,187,000</b>	<b>1,938,000</b>	
Project Leader	770,000	1,507,000		(11 x 137,000)
Treasurer	665,000	1,210,000		(11 x 110,000)
Adminitration Staff	490,000	770,000		(11 x 70,000)
Coordinator of supervisor	2,450,000	2,200,000		(11 x 200,000)
Supervisor	8,750,000	5,500,000		5(11 x 100,000)
<b>Daily Temporary Laborer</b>	<b>112,104,000</b>	<b>190,688,000</b>	<b>(78,584,000)</b>	
Driver	12,376,000	17,034,000		3(334x17,000)
Waste Transport	69,888,000	85,504,000		16(334x16,000)
Street sweeper	10,920,000	70,140,000		14(334x15,000)
Lebaran allowance	-	15,510,000		
Extra trips	2,500,000	2,500,000		
Health fund	-	-		
<b>2 Worktools</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>3 Fuel</b>	<b>23,850,000</b>	<b>19,288,500</b>	<b>4,561,500</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>13,470,000</b>	<b>13,470,000</b>	<b>-</b>	
Spare parts				
Inner tube/tire				
Oil				
Repair				
<b>5 Stationery</b>	<b>2,500,000</b>	<b>2,500,000</b>	<b>-</b>	
<b>6 Monitoring cost</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>7 Other cost</b>	<b>4,000,000</b>	<b>4,000,000</b>	<b>-</b>	
<b>B MAINTENANCE COSTS</b>	<b>5,951,000</b>	<b>25,244,500</b>	<b>(19,293,500)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>-</b>	<b>-</b>	<b>-</b>	
Calculator				
Typewriter				
Camera				
Amplifier TOA				
<b>Total DIKDA (A+B+C)</b>	<b>175,000,000</b>	<b>266,378,000</b>	<b>(91,378,000)</b>	



- ## SOLID WASTE MANAGEMENT PROGRAM

KOTA MANADO 2003

## PETA KECAMATAN WANEA

**Keterangan :**

- ☐ Jalan Utama
  - ☐ Jalan Lain
  - ☒ Batas Kecamatan
  - ☐ Batas Kelurahan

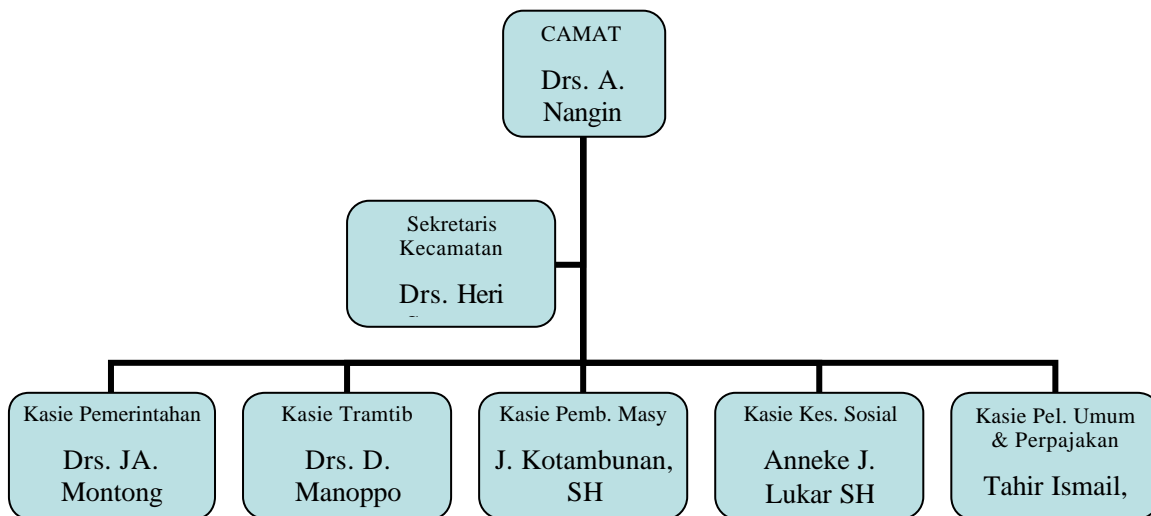
**Research Triangle Institute  
in association with  
p.t. Deserco Development Services**

## PROFIL KECAMATAN WENANG

Kecamatan Wenang terletak di pusat kota dengan luas 279.50 ha.

Batas administratif :   Utara               Kecamatan Tuminting dan Kecamatan Singkil  
                                   Selatan        Kecamatan Wanea dan Kecamatan Sario  
                                   Timur           Kecamatan Tikala  
                                   Barat           Teluk Manado

Jumlah Penduduk Kecamatan Wenang pada Tahun 2003 adalah 41.536 jiwa dengan 9.152 KK dan tingkat kepadatan penduduk rata-rata 148,61 jiwa/ha.



Struktur Organisasi Pemerintahan Kecamatan Wenang

Kecamatan Wenang terdiri atas 12 Kelurahan yang meliputi :

1. Calaca
2. Istiqlal
3. Penaesaan
4. Lawangirung
5. Komo Luar
6. Tikala Kumaraka
7. Mahakeret Timur
8. Mahakeret Barat
9. Wenang Utara
10. Wenang Selatan
11. Teling Bawah
12. Bumi Beringin

Sarana dan prasarana pengelolaan persampahan di kecamatan Wenang meliputi :

- |                    |           |
|--------------------|-----------|
| a. Dump Truck      | : 1 unit  |
| b. Truck Khas Kayu | : 3 unit  |
| c. Gerobak sampah  | : 20 unit |
| d. Container       | : 8 unit  |
| e. TPS             | : 14 unit |



f. Titik Sampah : 120 buah

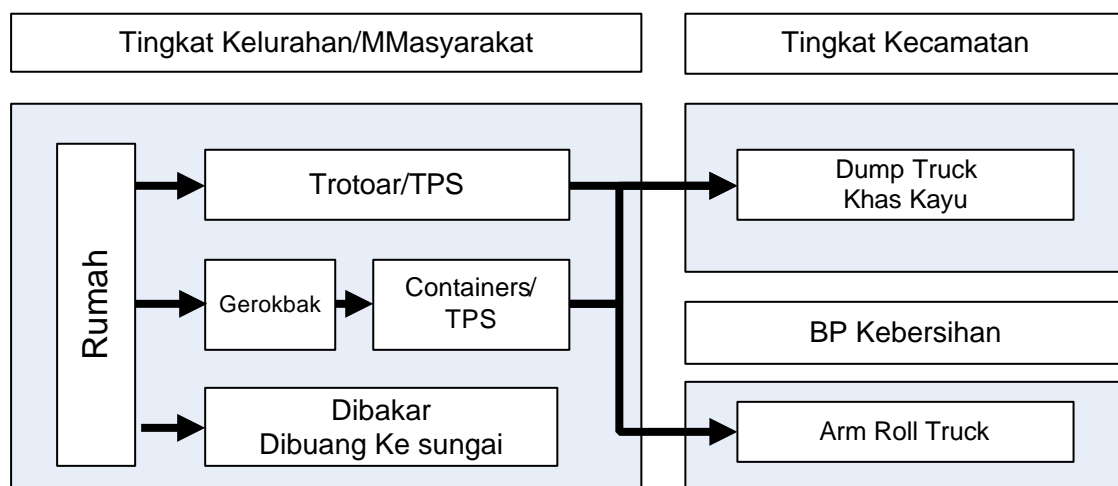
Timbulan sampah pada Kecamatan Wenang sebesar 203.84 m<sup>3</sup> /hari yang berasal dari sampah domestik (penduduk) dan sampah non domestik (pasar), sedangkan jumlah sampah terangkut sebesar 162.26 m<sup>3</sup>/hari dengan ritasi angkutan perhari 14,55 rit untuk seluruh pelayanan angkutan sampah..

Tenaga kerja kebersihan pada Kecamatan Wenang 98 orang yang terdiri atas 6 orang sopir, 36 orang krew kendaraan, 52 orang penyapu jalan dan 4 orang pendorong gerobak diwilayah pasar senggol.

Adapun lokasi jalan utama yang menerima pelayanan angkutan sampah diantaranya meliputi:

1. Jalan Piere Tandean
2. Jalan Sam Ratulangi
3. Jalan Diponegoro
4. Jalan Toar
5. Jalan Lumimut
6. Jalan 17 Agustus
7. Jalan WR. Supratman
8. Jalan Walanda Maramis
9. Jalan Sarapung dan Jalan DL. Lasut

Metode pengumpulan sampah untuk beberapa kelurahan dengan meletakkan sampah di trotoar dan atau memasukkannya ke TPS dan container yang dilakukan langsung oleh masyarakat tanpa adanya koordinasi dari pihak kelurahan, namun disebagian masyarakat ada yang pengumpulannya dilakukan dengan gerobak sampah dari rumah ke rumah dan dibawa ke TPS dan atau container. Dari TPS, titik sampah dan container selanjutnya dibawa ke TPA dengan menggunakan Dump Truck dan Truk Khas Kayu yang dikelola oleh Kecamatan dan dengan Arm Roll Truck yang dikelola oleh Badan Pengelola Kebersihan (BPK) dan sebagian kecil sampah ada yang dibakar oleh masyarakat.



Dalam pengelolaan kebersihan di Kecamatan Wenang untuk tahun 2003 telah dianggarkan dana sebesar Rp. 721.606.000,- (tidak termasuk ABT) melalui Anggaran Belanja dan Pendapatan Daerah Kota Manado Tahun 2003. Adapun komponen biaya tersebut meliputi :



1. Administrasi Proyek : Rp. 3.170.000,- (0.44 %)
2. Biaya operasional : Rp. 701.299.000,- (97.19%)
3. Biaya pemeliharaan kendaraan : Rp. 17.137.000,- (2.37%)

Selain dari pada pembiayaan dari APBD Kota Manado belum ada pembiayaan dari sumber lain.

Kondisi geografis Kecamatan Wenang secara fisik berbatasan dengan sungai Tondano terutama daerah dibagian utara dan berbatasan langsung dengan Teluk Manado untuk daerah bagian barat. Kondisi topografi memiliki kemiringan yang bervariasi, untuk daerah yang relative datar dengan kemiringan 0 – 8 % terdapat pada kelurahan Calaca, Istiqlal, Wenang Utara, sebagian Wenang Selatan, Penaesaan, Komo Luar dan Lawangirung. Untuk daerah yang dengan kemiringan lahan lebih besar dari 15 % sebagian terdapat pada kelurahan Bumi Beringin, Mahakeret Barat, Mahakeret Timur, Teling Bawah dan Tikala

KECAMATAN WENANG COMPARISON BETWEEN 2002 O & M COST REALIZATION AND CALCULATION				
	Actual Cost	Calculation	Differences	Notes
<b>A OPERATIONAL COSTS</b>	<b>277,315,000</b>	<b>601,040,600</b>	<b>(323,725,600)</b>	
<b>1 Salaries/Wages</b>	<b>238,814,400</b>	<b>555,919,000</b>	<b>(317,104,600)</b>	
<b>Project Administration</b>	<b>4,302,000</b>	<b>10,087,000</b>	<b>(5,785,000)</b>	
Project Leader	822,000	1,507,000		(11 x 137,000)
Treasurer	660,000	1,210,000		(11 x 110,000)
Administration Staff	420,000	770,000		(11 x 70,000)
Coordinator of supervisor	600,000	2,200,000		(11 x 200,000)
Supervisor	1,800,000	4,400,000		4(11 x 100,000)
<b>Contract Daily Laborer</b>	<b>234,512,400</b>	<b>545,832,000</b>	<b>(311,319,600)</b>	
Driver	18,478,800	34,068,000		6(334x17,000)
Waste Transport	95,133,600	192,384,000		36(334x16,000)
Street sweeper	120,900,000	260,520,000		52(334x15,000)
Lebaran allowance	-	43,740,000		
Additional trips	-	15,120,000		
Health fund	-			
<b>2 Worktools</b>	<b>-</b>	<b>-</b>	<b>-</b>	
<b>3 Fuel</b>	<b>37,467,000</b>	<b>44,088,000</b>	<b>(6,621,000)</b>	
Diesel fuel				
Premium				
Lubricating oil				
<b>4 Spare parts</b>	<b>-</b>			
Spare parts				
Tires				
Others				
<b>5 Stationery</b>	<b>1,033,600</b>	<b>1,033,600</b>	<b>-</b>	
<b>6 Monitoring cost</b>	<b>-</b>		<b>-</b>	
<b>7 Other cost</b>	<b>-</b>		<b>-</b>	
<b>B MAINTENANCE COSTS</b>	<b>20,410,000</b>	<b>48,664,000</b>	<b>(28,254,000)</b>	
Vehicles maintenance cost				
Other maintenance cost				
<b>C ASSET PURCHASE</b>	<b>2,275,000</b>	<b>2,275,000</b>	<b>-</b>	
Calculator	275,000			
Typewriter	2,000,000			
Camera				
Amplifier TOA	-			
<b>Total DIKDA (A+B+C)</b>	<b>300,000,000</b>	<b>651,979,600</b>	<b>(351,979,600)</b>	

Kumarakan.

1. Calaca
2. Istiqlal
3. Penaesaan
4. Lawangirung
5. Komo Luar
6. Tikala Kumaraka
7. Mahakeret Timur
8. Mahakeret Barat
9. Wenang Utara
10. Wenang Selatan
11. Teling Bawah
12. Bumi Beringin

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## Annex C

### Profile – Recyclable Markets in Manado

#### Recyclable Market Profile 1

**Business Owner:** Tengku Langi

**Address:** Jl. Buha, Lingkungan II, Kelurahan Buha (close to Sumompo),  
Kecamatan Mapanget

**Telephone:** 0812 430 3450

**Material collected:** plastic

**Business Capacity:** 6 tonnes/month or 10.5 tonnes/ 2 months  
Shipped to Surabaya (in container)

**Address of buyer:** PT. Duta Budi  
(Tulus Rejo)  
Jl. Perindustrian III/ 47  
Surabaya

**Regular waste collectors:** 3 including those in Pasar Jengki, in front of Toko Happy

#### Type of materials sold (mainly):

- Shampoo plastic bottles
- Water container (emberan)
- **Above Materials sold mixed and unseparated**

#### Prices:

- Buying: Rp. 600/ kg (mix of any kind of plastics)
- Selling: Rp. 750/ kg (average, different types of plastic have different price)
  - Price is based on Surabaya buyer's place/factory
  - Shipment cost to Surabaya: 400 Rp/kg
  - Price varies depending upon type of plastics
    - Shampoo plastic bottle: Rp. 2,000/ kg
    - Water container (emberan): Rp. 900/ kg

**Note:** - There are 50s type of plastic

- Best price: plain (uncolored) & no marking/brand, etc. ie. ex medical infusion plastic bottle, & glass size "aqua" yet light and wet & left water content → need blowing

**No. of worker:** - 7 persons (based on contract)  
- 3 adult women (housewives) & 4 girls

**Contract price per worker:** - 100 Rp/kg (gross-any kind of plastic)  
- capacity: 1 (gross) tonne/person/week

**Remarks:**

- “Aqua” bottle not the same as “kaki 3” or coca cola bottle
- “Aqua” bottle: easier to clean
- Coke: more time needed
- "Aqua" bottle (PET) not shipped → for seaweed; occasionally purchased
- ex lube oil bottle; occasionally purchased → for handicraft
- Sometimes receive cardboard
  - pressed from 3 m to 1/2 m thick (app. 50 kg)
- Shampoo plastic bottle shipped to Surabaya to be reprocessed for plastic pellet
  - Plastic factory using pellet in Manado located at Jl. Cereme
  - Using blowing machine → bottle, etc. again
  - If \$ down → original pellet preferred
  - If \$ up → mixed pellet with recycled ones desirable



Separation of plastic waste based on colors



Washed after cut into small chips



Drying



Packed into sacks before shipment

## Recyclable Market Profile 2

**Business Owner:** H.Mochammad Sjadjoem

**Management:** M.S. Kusumah (Rita/Sri Rahayu) → Financial & Administration  
Saiful Bahri → Technical-Operational

**Address:** Kairagi I Tiram  
Kec. Mapanget

**Telephone:** 812 805

**Rita address:** Perkamil BTN Blok F No. 100  
Telp. 869 801

**Material collected:** plastic

**Business Capacity:** 1~2 container(s)/month

→ “community waste”: app. 15 tonnes/mo. (mix of any kind of plastics)



→ “industrial waste”:

- “bimoli”: 1 ton/mo. average
- “aqua”: 10.5 tonnes/mo. average
- “coca cola”: uncertain

Note: could handle up to 350 kg/day gross

→ “aqua” 600 ml PET bottle: 50 kg/day

**Address of buyer:** Jakarta ("aqua" plastic shipment)  
 regular point: storehouse (gudang)  
 Jl. H. Menceng  
 Pluit, Tangerang

### Regular waste collector:

- About 12 "roda"/ base (pangkalan) incl. those from Km 5 (Sumompo), Taas, Tingkulu, in front of old movie theatre near Megawati Bridge at Pasar Calaca
  - Location of “roda”: (basically collecting plastics/ “dry” waste)
    - Bahu                      - Malalayang                      - Karombasan
    - Perkamil                - Pasar 45                      - Tingkulu (3 persons)
    - Tuminting (several)
    - Sario (2 persons; in front of Bahu Mall & next to Rock Rand Kafe in Ranotana)
    - others
  - In several cases: “roda” as scavengers and collector (“pengumpul”) → buy plastics from scavengers
  - Note: if has no capital, base is given Rp. 300,000 to 500,000 as stimulant capital, as long as has location, plastic to be picked up
  - This base was mostly owned by Mr. Sadjum’s ex subordinate when he was military chief controlling Sanger (Dandim)
  - Also from hospitals: Pancaran Kasih, Malalayang (Manado), Bitung (carried by hospital’s truck), Tomohon, Tondano → direct, not through “roda”
  - also from refill clean water facility (“AG”) → direct → unused plastic “gallon”

### Prices:

- Buying: 700 Rp/ kg mix plastic
- Selling: 2,000 Rp/kg (average)

### Note:

There are 86 types of plastic

Container (ember) made of poly propylene → middle price

PVC (pralon) burned: Jawa's price < 1,000 Rp/kg → not financially feasible if shipped to Jawa

Shipment cost to Jakarta: 500 Rp/kg (all in, door to door)

**No. of worker:** - 8 permanent  
 - could be more than 8 if more plastic received

**Contract price with worker:** - 500 Rp/kg

**Remarks:****Secured order/contract from:**

- "Aqua": 40 tonnes ongoing → since "aqua" started business in Manado
    - has handled app. 200 tonnes delivered in several packages over 2 years → time needed actually only 2 weeks → shipped to "aqua" factory in Jakarta
    - for plastic gallon → accumulated until certain amount then contracted in bulk
  - Coca cola: 60 tonnes of broken/ old bottle "crate"
    - Sjadjum takes crates already broken, cut into pieces from the factory to be cut into smaller pieces, washed, packed, and shipped to Jakarta's coca cola company
- If the processed product (plastic chips) not "clean" → not send to "aqua" or coca cola anymore → processed by plastics pellet factories (in Kapuk, Jakarta)
- "bimoli": unused cooking oil bottles → accumulated yearly then contracted

They estimated 60~70% plastics waste in Manado is recycled, remaining 30~40% wasted

In business since 1980s, Mr. Sadjum is originally from Sukabumi, West Java

20~30% reduction from those bought (gross) to sold (net) → average 75% net

Rita has taken part in environmental protection course → (simple) wastewater treatment plant built to process the wastewater from washing unit

- Existing process: wastewater from washing unit → filter → sedimentation tank → treated water to river, sludge buried

Unused plastic → burned

Vehicles operated: 2 (small) pick up trucks

**Recyclable Market Profile 3**

**Business Owner:** Purnomo Teguh (The Cun)  
Nontje Tunggadi

**Address:** Jl. A.A. Maramis No. 87, Kayu Watu, Kairagi II, Kecamatan Mapanget

**Telephone:** 812761

**Material collected:** cardboard (only)

**Business Capacity:** 2 containers/ shipment; 10 tones/ container  
1 shipment/ month → 20 tones/month  
arranged in packs (1 pack = 100 kg)

**Address of buyer:** Surabaya-Sidoarjo  
PT. Pakerin (long term buyer)  
→ reprocess to become cardboard again

**Regular waste collector:**

- 2 from Sumompo
- 2 from Taas
- supermarkets: many, sometimes 100 kg/time

**Prices:**

- Buying: 300 ~ 400 Rp./kg
- Selling: 1,000 Rp./kg
  - not incl. insurance
  - franco buyer's storehouse in Surabaya
  - shipment cost to Surabaya: 400 Rp/kg

**No. of worker:** - 2 persons

**Contract price with worker:** - 10,000 ~ 15,000 Rp/kg

- meal allowance: 7,000 Rp/day
- if there's cardboard there's work
- Saturday: half day
- Sunday: holiday

**Remarks:**

- 5~6% reduction from those bought (gross) to sold (net)
- used to collect bones (for buttons, etc.), shoes' heel (plastic parts taken for water jug-  
"ember")
- Toko Dwikarya processes low quality cardboard to be reprocessed for eggs "cushion"  
→ has poultry too
- from Makassar



Cardboards ready for pressing and packing





Pressing and packing



After completely packed ready for shipment

## Recyclable Market Profile 4

**Business Owner:** H. Kadir Pakaya  
Ardin Noho (assistant)

**Address:** Tuminting

**Telephone:**

**Material collected:** Metal/ scrap iron

**Business Capacity:** 3~4 containers/month  
10 ton/month (copper mix Aluminum)  
60~70 ton/month (iron)  
10~15 ton (ex battery)  
(if shipment exceeds Rp. 300 million → insured)

**Address of buyer:** Surabaya (nationally, final destination: Jakarta or Surabaya)  
→ from Manado, Makassar, & Gorontalo → all to Surabaya

**Regular waste collector:**

- 12 incl. those at Jl. Roda
- there are about 50 metal scavengers in Manado

**Prices:**

- Buying: 500 Rp./kg (scrap iron)  
10,000 Rp./kg (copper)  
7,000 Rp./kg (aluminum)
- Selling: 1,000 Rp./kg (scrap iron)  
12,000 Rp./kg (copper)  
9,000 Rp./kg aluminum (2,000 Rp/kg gross profit, 1,000 Rp/kg net profit)

**No. of worker:** - 12 permanent  
- payment weekly  
- job: pressing

**Contract price with worker:**

- If contracted: - 150 Rp/kg (frying pan)  
- 300 Rp/kg (boiling pan)  
- 400 Rp/kg (can, Aluminum pan)
- If daily: - 20,000/day (frying pan)  
- 25,000/day (boiling pan)  
- 35,000/day (can, Aluminum pan)

**Remarks:**

- Origin from Gorontalo & has been 10 years in the business
- Major broker for Gorontalo, North Sulawesi, Ternate
- There are 4 other brokers shipping to Surabaya, yet smaller: in Teling 2, Perkamil, Sumompo, Calaca
- Shipment cost to Surabaya: 3 million Rp/container
- 1 container = 20 ton (25 max)
- Shipment cost: 100 Rp/ kg iron
- Many kind of metal/iron, ie. aluminum: wire, knee, (thick) pan, can, frying pan
- 4 types of copper: wire, dynamo, plain
- 2 types of bronze: “kuningan”, “bubukan” (crushed)
- No casting factory in Manado (There was a plan to build one in Kalasey but it was cancelled)



Piles of metal/ scrap iron



After pressed than put into sacks and weighted

## Annex D

### Profile – Cleanliness Competition Programs in Manado

#### National Programs

The City of Manado appears to take great pride in the fact that it been the recipient of the Adipura Award which was developed to recognize clean communities throughout Indonesia. The City of Manado won this prestigious award in the recent past. As a successor to the Adipura program, the central government has launched a similar program called Bangun Praja Lingkungan. This program, led by the Ministry of Environment, is broader in terms of its evaluation aspects. The major goal of the program is to encourage local government to perform well from an environmental perspective. Guidelines are established by which local governments will be evaluated. Issues evaluated in 2002/2003:

- Solid waste management
- Public space infrastructure
- Public facilities
- Water quality.

These issues were viewed from three perspectives including 1) management, 2) community empowerment, and 3) physical characteristics. The program intent is that evaluations would be conducted regularly so that a change in performance could be measured. The program results are also expected to serve as a way of making public performance accountable to the public thereby promoting a transparent, accountable, and participative government.

The program evaluation team is composed of a field team (Tim Lapangan - TL), a city evaluation board (Dewan Evaluasi Kota - DEK), and a national board (Dewan Pertimbangan Nasional - DPN). Monitoring is to be regularly held once every four months with the evaluation done annually.

For the 2003 competition, the national evaluation team conducted an assessment in Manado in August and December 2002 as well as in April 2003. However, the City was not successful in this period. Badung/Kuta & Tabanan in Bali were announced as winners in June 2003. (For the next evaluation period, the national evaluation team is expected to come to Manado in early December 2003 and a further announcement of a new winner is expected in June 2004.)

#### Manado Local Programs

In addition to the above national program, the city has created its own competitive program called Bangun Praja Berhikmat. This program is designed to help achieve the city's goal of being seen as a clean and green city. Bangun Praja Berhikmat covers three main aspects:

- Solid waste
- Orderliness
- Green spaces

An evaluation team was established by the City to include all key stakeholders in the city. Last year, the team was called "Tim Penilai" (Evaluation Team). For the coming year it will

be identified as “Tim Bangun Praja” (Bangun Praja Team). The evaluation team is made up of:

- BPLH (Badan Pengelola Lingkungan Hidup - Agency for Environmental Affairs) which only serves as facilitator and secretary for the evaluation team.
- A community representative
- A media representative
- Religion leaders through the BKSUA (Badan Kerja Sama Umat Agama) a multi-religion cooperation body.
- University/campus representatives from several departments including environment, urban planning, etc.
- Youth organization representative.

The evaluation is intended to use the same basic criteria used by the central government program (Bangun Praja Lingkungan). Through the evaluation, kelurahan would be ranked into four categories, namely, 4 star “teladan” (champion), 3 star “pelopor” (initiator-pioneer), 2 star “perintis” (pioneer), mosquito/fly “kotor” (dirty).

In the initial evaluation, each kecamatan proposed its best kelurahan. As a result, 9 kelurahan were evaluated. In addition, a special area (kawasan) that was composed of markets and selected commercial areas was also evaluated. Markets evaluated included all formal markets in the city, while commercial areas included 5 major shopping areas (Matahari, Coco, Wanea Plaza, Manado Plaza and Bahu Mall).

The four best kelurahans identified by the Bangun Praja Team were:

- Ranotana (Kec. Sario)
- Bahu (Kec. Malalayang)
- Bumi Beringin (Kec. Wenang)
- Meras (Kec. Bunaken).

The winners of the competition will be rewarded a study tour to the national champion community in Bali (Badung/ Kuta & Tabanan). The people that will go on the study tour from each kelurahan includes: lurah (head of kelurahan), head of LPM (Lembaga Pemberdayaan Masyarakat-Community Empowerment Body) who is regarded as representative of community, and other representatives from local government. The intent of the study tour is to reinforce the motivation for maintaining a clean district.

The next competition and evaluation is expected to begin soon after the end of Ramadan). There has been some consideration that the program would be expanded to evaluate schools and (kawasan) office buildings (including both private and local government offices).

The SWM practices in the winning kelurahan can serve as a model by which to base other programs throughout the City. A profile for the winning kelurahan (KELURAHAN RANOTANA in Kecamatan Sario follows:

Kelurahan Ronatana was voted best kelurahan of the “Bangun Praja Lingkungan Berhikmat” (clean and green city) competition in 2003. Key information concerning Kelurahan Ranotana is shown below:

### **Description of Kelurahan**

Head of Kelurahan (Lurah):

F.P. Mawicere

Head of Community Empowerment Board (LPM)	Novi M.
Population:	4,896 people
No. of households:	703 households
Size of area:	25 Ha
No. of Lingkungan:	6 Lingkungan

### **Solid Waste Collection Program Description**

Solid waste collection in the kelurahan is accomplished using door to door collection through the use of push carts. Collection personnel and equipment include the following:

No. of cart pullers:	6 persons
No. of carts:	13 units, 3 of them currently broken
Origin of carts:	7 units from LPM, 2 units from PLN, and 4 units from kecamatan.

Door to door collection from households is occurs either in the morning or late in the afternoon. Collected solid waste is then brought to two TPS: one is located close to Gran Puri Hotel, and the other is located in front of Polda Sulut office (next to PLN office ) at Jl. Bathesda.

Evaluation of the collection system (waste quantities and fees collected) in every lingkungan is done regularly on monthly basis by holding multi-party meeting facilitated by the kelurahan. These monthly meetings include representatives of the community, lingkungan, and LPM.

System's financial needs are met through collection of a fee from every household and store/shop. Fee collection is managed by the respective Lingkungan in which the generator is located. The amount of fee is determined through mutual agreement between Lingkungan and community and the LPM at the time of the aforementioned monthly meeting. The fees vary from Rp. 2,500 to Rp. 4,000. Houses with rented rooms are charged a higher fee with an additional Rp. 2,000 charged for every rented room. The fees that are collected cover not only pay for the cart pullers, but also for maintenance and replacement of carts.

## Annex E

### Needs Assessment Criteria for BPK/Kecamatan/Kelurahan Evaluation

*Important that both hard aspects (containers, vehicles, transfer points, transfer stations, etc.) and the soft issues (scheduling, route structures, fee systems, legal/political framework, etc.) be evaluated geographically and politically.*

#### Reasons to Evaluate Solid Waste Collection

- 1. Fundamental Changes in the Required Collection Structure –**
  - a. What impact will the establishment of new regional disposal facilities have on collection practices and the need for secondary transfer?
- 2. Level of service:**
  - a. What level of service is required to meet the communities' needs?
  - b. What expectations exist with respect to the frequency of pickup and the convenience of set-out or communal collection requirements for solid waste generators at the local government level?
- 3. Roles for the public and private sectors:**
  - a. Is there a policy preference regarding the roles of the public and private sectors in providing waste collection services? How will the informal private sector participate in the program?
  - b. Is the informal private sector apt to be an impediment to achieving effective collection?
- 4. System funding:**
  - a. How can any improvements in solid waste collection be funded?

#### Establish Sustainable Objectives for Effective Collection and Transfer

1. Requires that a desired level of service be defined.
2. Frequency of routine collection and type of collection service commonly defines level of Service.
3. Level of service determines the cost of collection.

#### Needs Assessment Steps and Criteria

##### Step 1: Conduct Collection Situation Analysis

- |   |   |
|---|---|
| <ol style="list-style-type: none"><li>1. Gather background data.<ol style="list-style-type: none"><li>a. Applicable laws and regulations</li><li>b. Demographics</li><li>c. Physical characteristics</li><li>d. Land use.</li></ol></li></ol>               | <ol style="list-style-type: none"><li>2. Inventory and assess existing conditions<ol style="list-style-type: none"><li>a. Waste composition</li><li>b. Generator storage and handling practices</li><li>c. Collection service</li><li>d. Diversion methods and programs</li><li>e. Disposal facilities.</li></ol></li></ol> |
| <ol style="list-style-type: none"><li>3. Obtain input from residents and businesses.<ol style="list-style-type: none"><li>a. Formal:<ol style="list-style-type: none"><li>i. Reuse</li><li>ii. Recycling</li></ol></li><li>b. Informal:</li></ol></li></ol> | <ol style="list-style-type: none"><li>4. Waste Characterization:<ol style="list-style-type: none"><li>a. Sources</li><li>b. Types</li><li>c. Quantities</li><li>d. Seasonal variations</li></ol></li></ol>  |

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>c. Reuse</li> <li>d. Recycling</li> </ul>  | <ul style="list-style-type: none"> <li>e. Composition</li> <li>f. Density</li> </ul>   |
| <ul style="list-style-type: none"> <li>5. Generator Storage and Handling Practices:               <ul style="list-style-type: none"> <li>a. Container types used</li> <li>b. Accumulated waste assessment</li> </ul> </li> </ul>  | <ul style="list-style-type: none"> <li>6. Environmental, health and safety impacts</li> </ul>  |
| <ul style="list-style-type: none"> <li>7. Impediments to best practices.</li> </ul>   | <ul style="list-style-type: none"> <li>8. Collection Service:               <ul style="list-style-type: none"> <li>a. Management and administration</li> <li>b. Collection practices</li> <li>c. Operational performance</li> <li>d. Environmental performance</li> <li>e. Financing methods and costs.</li> </ul> </li> </ul> |
| <ul style="list-style-type: none"> <li>9. Diversion Methods and Programs</li> </ul>   | <ul style="list-style-type: none"> <li>10. Disposal Facilities:               <ul style="list-style-type: none"> <li>a. Expected life (years)</li> <li>b. Operational impacts on collection equipment</li> <li>c. Compliance with regulations</li> <li>d. Cost</li> </ul> </li> </ul>  |
| <ul style="list-style-type: none"> <li>11. Obtain Input from Residents and Businesses               <ul style="list-style-type: none"> <li>a. Expectations for the type of service and its frequency.</li> <li>b. Willingness to co-operate in planning and implementation of improved service.</li> <li>c. Ability and willingness to pay for improved service.</li> </ul> </li> </ul> |  |

## Step 2: Establish Program and Service Goals

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1. Collection system planning guidelines:               <ul style="list-style-type: none"> <li>a. Collection is complex and costly</li> <li>b. There is no one solution</li> <li>c. Must balance service with ability and willingness to pay</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>2. Typical public goals:               <ul style="list-style-type: none"> <li>a. Convenient point of collection</li> <li>b. Service reliability</li> <li>c. Enforcement of applicable laws</li> <li>d. Improved public awareness and behavior</li> <li>e. Adequate and sustainable funding</li> <li>f. Monitoring of the service provider</li> <li>g. Equity of costs and benefits received.</li> </ul> </li> </ul> |
|--|--|

## Step 3: Identify Options for Improving Collection Service

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>1. Point of collection</li> <li>3. Handling of recyclable materials</li> <li>5. Collection frequency</li> </ul> | <ul style="list-style-type: none"> <li>2. Materials to be collected</li> <li>4. Method of collection</li> <li>6. Service provider.</li> </ul> |
|--|---|

## Step 4: Evaluate Potentially Viable Collection System Options

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1. Evaluate applicability of strategic element options.</li> <li>3. Develop preliminary cost estimates for each scenario.</li> </ul> | <ul style="list-style-type: none"> <li>2. Formulate potentially viable system scenarios.</li> <li>4. Evaluate applicability of strategic element options:               <ul style="list-style-type: none"> <li>a. Point of collection</li> </ul> </li> </ul> |
|---|--|



- |   |  |
|---|--|
| <ol style="list-style-type: none"> <li>5. Evaluation criteria: <ol style="list-style-type: none"> <li>a. Compliance with laws and ordinances</li> <li>b. Cost effectiveness</li> <li>c. Health/Safety</li> <li>d. Environmental compatibility</li> <li>e. Effectiveness</li> <li>f. Public acceptance</li> <li>g. Efficiency</li> </ol> </li> <li>7. Method of collection: <ol style="list-style-type: none"> <li>a. Manual collection</li> <li>b. Semi-automated collection</li> <li>c. Automated collection</li> </ol> </li> <li>9. Storage container type: <ol style="list-style-type: none"> <li>a. Plastic bags</li> <li>b. Metal or plastic rigid containers</li> <li>c. Rollout carts</li> <li>d. Large metal or plastic bins</li> </ol> </li> <li>11. Formulate potentially viable system scenarios.</li> <li>13. Use data from operational experience and assessment of existing collection system.</li> </ol> | <ol style="list-style-type: none"> <li> <ol style="list-style-type: none"> <li>b. Materials to be collected</li> <li>c. Method of collection</li> <li>d. Storage container type</li> <li>e. Frequency of collection</li> </ol> </li> <li>6. Point of collection options: <ol style="list-style-type: none"> <li>a. At the door</li> <li>b. At the building</li> <li>c. Waste pooling sites</li> </ol> </li> <li>8. Materials to be collected: <ol style="list-style-type: none"> <li>a. Bulky wastes</li> <li>b. Construction and demolition wastes (C&amp;D)</li> <li>c. Yard wastes</li> </ol> </li> <li>10. Collection frequency: <ol style="list-style-type: none"> <li>a. Twice weekly</li> <li>b. Three times weekly</li> <li>c. Six times weekly</li> <li>d. Daily (seven times weekly)</li> </ol> </li> <li>12. Develop preliminary cost estimates for each scenario.</li> </ol> |
|---|--|

### **Step 5: Select the Preferred Collection System**

1. Solicit stakeholder input.
2. Compare cost of each scenario with ability to pay.
3. Make final decisions regarding strategic service elements and service provider.
4. Make final strategic decisions:
  - a. Point of collection
  - b. Materials to be collected
  - c. Storage container type
  - d. Method of collection
  - e. Frequency of collection
  - f. Service provider.

### **Step 6: Implement the Selected Program**

1. Develop a public awareness and communication program.
2. Establish the Program Funding Mechanism.
  - a. Decide who will pay for waste collection service.
  - b. Decide how the money will be collected.

## Annex F

### Sustainable Solid Waste Management Practices Summary

#### F.1 Sustainability

In evaluating current and proposed solid waste management practices and technical options, planners in developing countries must work to identify **sound practices** that should be applied to the specific conditions that exist in Indonesian rural and urban communities. There are a number of factors that must be considered to determine what defines sound practices in solid waste management in developing countries.

In a general sense, a successful municipal solid waste management practice will be **sustainable** so that it can continue to exist beyond its initial implementation. There are many cases throughout the world where the availability of new equipment (such as waste collection vehicles) or the installation of new processing facilities (such as compost plants) did not fulfill expectations created at the time that the new systems were put into place. Insufficient institutional or financial capacity can lead to a situation where a new solid waste management asset cannot be operated, maintained, or managed successfully in a sustainable manner. This is particularly the case in countries where donor-supplied equipment and facilities are put into place without the proper consideration of what it takes to keep the systems operable and efficient for their full technical life expectancy. System failures are common when a strong dependency is created on the donor process without establishing the ability to locally finance additional equipment and facilities required to eventually replace donor systems.

As a result of the emerging perception that a sound institutional and financial foundation has to exist to support the implementation of new systems and equipment, current practices in Indonesia must be evaluated to define a beginning point for any recommendations of the technical options available to improve solid waste management. This review of current practices must range from the actions undertaken by residents to minimize the amount of solid waste sent to the final processing and disposal facilities managed by local government. This definition of a comprehensive starting point is important for a number of reasons:

1. Successful solid waste management requires an integrated view of all practices utilized in handling the municipal solid waste stream. Any process involved in the management of the waste stream has an impact on other processes within the same integrated program. For example, the level of formal or informal recycling can have a major impact on the feasibility or performance of incineration or composting plants.
2. The work required to implement effective solid waste management in total is often daunting. A correct identification and definition of current practices and deficiencies from a sound practice standpoint can help to design a development or process enhancement that begins to show progress soon after it has begun. As is often the case in dealing with complex issues such as solid waste management, progress fuels the ability to achieve further progress so that a resolution momentum is established, ultimately leading to effective waste management practices.
3. In many countries, the “solid waste problem” is made up of many facets and cannot be solved without addressing root issues including the generation of solid waste as well as the means of its collection, processing and disposal. While the installation of a new technology such as compost or incineration plant can be an important part of the

ultimate waste management system, it usually will not solve all of the problems that must be addressed in developing an effective overall program.

Given the complexity of dealing with most solid waste problems in transitional economies, there must be basic “drivers” that create implementation momentum for solving the overall problems. These generally include:

1. The **social-needs** driver is believed to be in place in Indonesia since it is generally accepted that there are solid waste problems to be addressed. However, for ultimate success, progress must be sustained through well-defined regulatory or economic drivers.
2. Through a **regulatory** driver, enforceable laws and regulations must exist to maintain reasonable standards. This must be accompanied with the ability and willingness to enforce standards on both a national and local level.
3. In industrialized countries, the **economic** driver has helped to develop many effective means of solid waste management by providing lower costs than would be experienced in competing technologies. Increased regulation generally leads to increased cost. In turn, increased cost leads to the effectiveness of the economic driver through the stimulation of technologies and systems that are aimed at meeting applicable regulations while keeping overall costs of solid waste management at a minimum.

Solid waste planners must evaluate the technical options available for solid waste management in Indonesia by placing each possible option to the test of elementary questions important to establishing the solid waste management option’s sustainability.

- Is the practice technically feasible and appropriate for the needs of the area, given the financial and human resources available?
- Is the practice the most cost-effective option available?
- What are the environmental benefits and cost of the practice when compared to the ramifications of the current practice?
- How will the proposed practice affect the social welfare of all people (formal and informal) currently involved in solid waste management or living in proximity to a planned facility such as a new disposal area?
- Can the practice or system be sustained given the existing institutional framework available in the area? If not, what institutional strengthening is required to maintain progress and sustain the sound practice?
- Can the private sector and/or NGOs play a role or take the lead in instituting or maintaining the practice?

There is considerable worldwide experience available by which sound practices of solid waste management can be defined. The existing solid waste management conditions in Indonesia are not unique. In many areas, effective collection is difficult to achieve in low-income areas because of physical constraints or the inability of residents of those areas to pay for effective waste management services. In some countries, a strong informal sector exists which significantly influences solid waste management practices and options in the area. Unfortunately, the positive influence of the significant recycling and reuse that results from the actions of the informal sector is often offset by the health and safety issues that they are exposed to in accomplishing the informal recycling. Also, there is generally less control over the actions of the informal sector and it often contributes to overall littering.

The evaluation of the solid waste management conditions to define sound practices involves the investigation of a number of factors including:

1. Availability of financial resources to implement new or enhanced processes
2. Level of economic development in the area of evaluation including relative cost of resources (capital, labor, etc.)
3. Level of technological development (availability of local equipment and services, etc.)
4. Level of human resource development in the municipal solid waste field (trained and competent technicians, managers, etc.) and in society in general (effective labor, etc.)
5. Physical conditions of collection areas including residences, container locations, access roads, etc.)
6. Physical conditions of disposal areas such as topography, soil characteristics, hydrogeology and the type/proximity of water bodies.
7. General climate conditions that may influence system design features (temperature, rainfall, prevailing winds, etc.)
8. Specific environmental sensitivities of the region such as the extent of air pollution or the condition of water bodies near disposal areas, etc.
9. Solid waste characteristics including composition, density, moisture content, combustibility, recyclable content, and the inclusion of hazardous or biomedical waste in the municipal solid waste stream.
10. Demographic and geographic characteristics such as size, population density, and infrastructure development, political jurisdictions, waste shed definitions
11. Degree to which solid waste management decisions are constrained by political considerations and the nature of those constraints
12. Existence or effectiveness of regulatory laws and enforcement
13. Policy initiatives that may exist or are under development that will influence the development of an effective solid waste management system
14. Social and cultural practices
15. Extent of informal practices

The intent of the proposed feasibility study is to assist in the identification of several of the above factors that are key to the definition of sustainable and effective solid waste management practices for local communities in Indonesia.

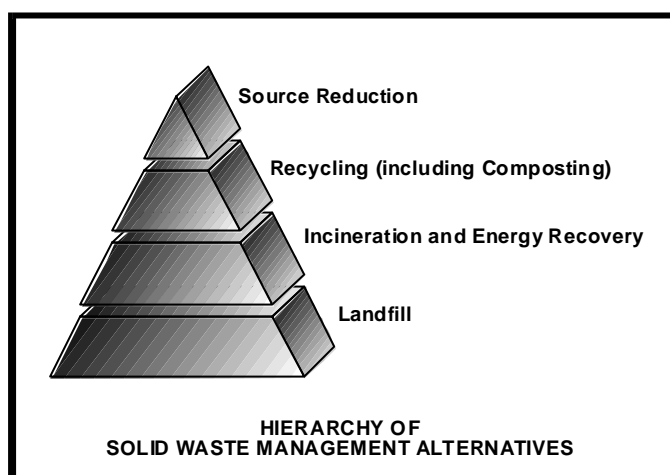
Solid waste planners must clearly recognize that there are major differences in the manner in which solid waste is managed in industrial and developing/transitional countries. These differences account for the dissimilarity in the properties of the municipal solid waste stream at various points in the management cycle. This difference becomes important in recognizing that many of the systems that have been implemented in industrialized countries may not be applicable to Ivorian communities. This understanding is also fundamental to defining sound practices applicable to Indonesia.

## **F.2 Integration**

Often times, a specific system or practice is recommended as the preferred solution to a solid waste management problem. While such proposals may be practical in addressing a specific need, there are examples across the world where high technology systems were

installed that have had minimal influence on the root issues of the problem. Because of this, many successful solid waste planners argue that an effective solid waste system requires integration of all aspects of the problem, as well as thorough consideration of all potential solutions.

In industrialized countries with well developed solid waste management standards, the term **“Integrated Solid Waste Management”** has meant the use of appropriate technologies and procedures in the various elements of an effective solid waste management program aimed



at defining the ultimate disposition of the solid waste stream. An integrated solid waste management system may prioritize its waste management options according to waste minimization, materials recovery/recycling, composting, incineration, and landfilling. The schematic shown in Figure F.1 illustrates the general hierarchy of solid waste management choices commonly accepted throughout the world in the definition of integrated solid waste management. The schematic shows the generally preferred approaches to treating and

disposing of municipal solid waste.

For the sake of this definition of sound practice, our definition of Integrated Solid Waste Management includes:

1. **Source Reduction** - Through source reduction, the total amount of municipal solid waste requiring management can be reduced through direct reuse of materials by the generators or by the alteration of packaging or purchasing practices influencing the amount of solid waste generated. Source reduction prevents the solid waste materials from formally entering the solid waste stream. Waste minimization or source reduction focuses on reducing the quantity and potential toxicity of solid waste destined for the landfill. This means less material to be handled throughout the system with less risk.
2. **Recycle/Reuse** – After material has entered the solid waste management stream, various components can be separated for reuse or for development of new products. In many countries this is accomplished through 1) source separation where components of the waste stream are kept separate by the generator and collected independently or 2) through separation after the mixed solid waste enters the solid waste stream. This latter process is often accomplished by the informal sector. This level of the preferential hierarchy also includes composting on both a small and large scale. Materials recovery and recycling reduces the amount of material to be disposed of and, as a result, extends the life of the landfill. It also provides the additional benefit of reducing the consumption of raw materials. Composting diverts organic matter from the landfill. This can reduce gas and leachate risks at the landfill and extend the life of the facility.
3. **Incineration/Waste-to-Energy** – From a solid waste management perspective, this is considered a means of volume reduction before final disposal. In many industrialized countries, the use of incineration in solid waste management has diminished greatly in recent years because of the concern about health effects associated with air emissions

and residue management and overall cost of such systems when compared with other management alternatives.

4. **Landfill Disposal** – Environmentally sound solid waste disposal must be part of any effective solid waste management program. In most industrialized countries, this is the waste management process of last resort where all other elements of the integrated management approach are aimed at minimizing the quantity of municipal solid waste ultimately requiring disposal. There are no currently available solid waste management techniques that will result in a complete elimination of the need for environmentally sound landfills.

Although not specifically shown in this classic hierarchy of solid waste management options, collection and transport play a major role in the overall effectiveness of any integrated solid waste management program. This is particularly the case in transitional countries where that solid waste stream is subject to significant informal activity including recycling and composting. For that reason, collection and transport issues must be closely investigated to determine their effect on the perception of a solid waste program and to evaluate the effect that these issues will have on processing and disposal options.

RTI's work in Manado has been based on the world-wide experience that defines what sound practices are available for use in Indonesia. Some of these sound practices are defined in greater detail below. This information is intended to provide a technical and experience framework to the various recommendations that have been included in the project work and to the implementation processes described in this workshop.

### **F.3 Sound Practices - Source Reduction**

There are a number of source reduction processes that are generally considered to be sound practice. Logically, the proper starting point for addressing any solid waste management issue is the reduction of the amount of solid waste that must be collected and disposed of. Generally, actions aimed at source reduction occur at both national and local levels. Some national efforts can include:

1. Promotion of programs increasing environmental and, particularly, solid waste management awareness.
2. Promotion of sound packaging approaches aimed at reducing the solid waste that remains after consumer use.
3. The promotion of programs that enhance producer responsibility for post-consumer waste derived from their products.

Local source-reduction efforts can include:

1. Promotion of local programs increasing public awareness of solid waste management issues.
2. Political pressure on national efforts aimed at influencing packaging practices.
3. Promotion and support of any program that diverts recyclable or reusable components from the waste stream prior to final disposal.

Since such efforts may eventually decrease the amount of solid waste to be managed, they should continue on all levels of government.

### **F.4 Sound Practices – Waste Reduction**

The manner and extent of waste reduction strongly influences the solid waste management choices that are appropriate for Ivorian communities. This is particularly the case in

considering high technology approaches such as mechanized composting and waste-to-energy systems.

In countries with transitional economies, the level of repair and reuse, as well as the sale and gift of used goods will be found to a greater extent in low income rather than higher income areas. Generally, this is driven by scarcity and frugal values associated with low income. This general practice can be expected to continue until overall standards of living increase.

So long as the informal and formal processes for eliminating non-organic fractions from the waste stream can be brought into control, a sound practice for local governments in transitional countries is to emphasize the diversion of organic material from the waste stream to small to moderate scale composting systems. The high percentage of the organic fraction provides the greatest opportunity for diversion from disposal facilities. However, the means by which this diversion occurs will be important in determining the quality of the compost derived.

Based on observations during the work in a number of developing countries, recycling occurs at three points in the solid waste management system. Initial recycling begins with scavengers who remove materials from containers or waste piles on the street before collection. The second level occurs on the collection trucks. Collection workers remove materials as they are collecting the waste. Materials are placed in sacks, boxes or wherever convenient on the collection truck. In some cases, each worker on the truck had his own material sacks, so that the trucks had as many as 15 individual sacks holding materials. Unfortunately, this second level of recycling can impact collection efficiency.

The third level of recycling is at the landfill. Materials are removed from waste that is dumped in the landfill by scavengers who work in very poor conditions generally at considerable risk. Many of the people live at the landfill or in nearby shanty towns. In larger landfills, scavengers are a major problem and hinder proper landfill operation. The recovered materials are obviously dirty and of a lower quality than those removed earlier in the system. Plastic bottles recycled from the landfill yield a lower price because they must be washed before the market will accept them. Due to the negative impacts of having recycling occur at the landfill, it is desirable to shift recycling toward the generation and collection end of the system and away from the landfill.

After the initial removal of the materials, they are sold and processed through a series of processors. Generally, paper and cardboard are baled by hand and transported to markets, some at a considerable distance.

## **F.5 Sound Practice – Collection and Transfer**

Collection and transfer is that part of a solid waste management system that is most visible to the public in any urban area. It also accounts for a significant portion of the cost for municipal solid waste management. In industrialized countries, collection costs range from 60 to 70% of the total cost; while developing or transitional countries spend from 70 to 90% of the total cost of solid waste management. While the percentage of total cost allocation to collection is higher in transitional countries, this does not mean that a collection system is more efficient. Typically, the service is inefficient since workers are often unmotivated, untrained and insufficiently compensated. In addition, collection is often carried out using obsolete equipment that is not well maintained. Typically, the level of service is determined by the stature of the collection area where poor areas receive a lower level of service. The high percentage of cost allocation for collection is also affected by the frequency of

collection. In developing and transitional countries, collection of solid waste can occur frequently, in some cases daily.

Sound practices include the use of compactor trucks and other such vehicles specifically designed for the collection of solid waste. Non-compactor trucks are also used to collect solid waste. Some communities provide collection through a container-based system where solid waste receptacles are placed at strategic locations for receipt of waste from generators and eventual pick up by the community or a private contractor. The type of equipment used for collection is a function of a number of factors including:

- The cost of labor and services
- The nature of collection routes (street widths, etc.)
- Historical practices
- Recycling practices

## F.6 Sound Practice - Composting

Composting solid waste for agriculture is an important solid waste management process in many countries. This is particularly true in some areas of the world where composting has been used for generations. There are many successful small and medium-sized composting installations that are functioning successfully in countries such as China and India. Unfortunately, there are also examples of many attempts at establishing composting in developing or transitional countries that have failed. This is particularly the case where large mixed waste compost plants have been constructed. Common reasons for such failures have included:

1. **Economic Failure** - In some cases, there has been an inability to secure sufficient waste to process as a result of the competing costs of disposal alternatives. Compost plants have also failed as a result of an inability to market end-product compost. This is often a function of agricultural practices in the region where the compost is produced. These practices will determine the external demand to use the material as a soil conditioner. Experience across the world has shown that compost marketing works best when:
  - The available markets are near the source of production
  - The compost producers are willing to transport it to the consumers
  - The compost is priced below other commercially available soil conditioners or given away to the consumers.
2. **Technical Failure** – Some of the world-wide composting failures have been due to technical issues. Technical failures can include:
  - Failure of the mechanical pre-processing systems used to condition the solid waste for composting,
  - Failure of the biological process as a result of not controlling the parameters (moisture content, carbon/nitrogen ratio, etc.) required for effective compost production
  - Insufficient organic content to support the process.

The compost systems that have generally been effective across the world are those that focus on the use of source-separated materials that are high in organic content. Examples of



such materials include animal and vegetable waste. Generally, successful compost facilities in developing and transitional countries have the following features:

- The material processed must be compostable in order to produce a marketable product.
- Mechanical pre-processing of mixed solid waste is difficult and, in most cases, has not been successful.
- Manual pre-processing has been successful in small to medium applications for highly compostable waste streams.
- Economic factors such as competing disposal costs, markets, and material recovery costs support the ongoing supply of compostable material to the compost facility.

Composting is a specialized process requiring a good understanding of the materials being composted and the composting process. Composting is gaining in popularity in the United States and Europe. The driving force behind this trend is the increasing cost of landfilling. In Indonesia, landfill costs should remain low, well below the cost of producing compost. However, the same conditions that favor landfilling, dry climate and impermeable soils, also make compost a valuable product. The goal should be to find a cost effective compost process that results in costs similar if not less than landfilling and low enough to attract an agricultural market.

## **F.7 Sound Practice – Incineration**

From a solid waste management perspective, the primary benefit of incineration is the volume (up to 90%) and weight (up to 70%) reduction of the solid waste that is incinerated. In the United States and the EU, this has been an important factor in developing such facilities because of the scarcity of landfill space. In areas where landfill space is scarce, the cost of disposal has usually been sufficiently high to support the high costs of contemporary waste-to-energy facilities. There are very few incineration facilities that have been built in the last 25 years that were not designed as energy recovery facilities. In addition to the benefit of deriving energy from the combustion process, a waste-to-energy facility allows combustion gases to be cooled (as the recovered energy is extracted from the combustion gases) so that the gases can be effectively treated by the extensive air pollution control systems currently required by law in most industrialized countries. In most countries where incinerators have been developed, increasing concern with air emissions has led to fewer and fewer such facilities under planning and development.

There are a number of factors that must be considered in evaluating the potential of waste-to-energy facilities in developing or transitional countries. The high capital and operating costs associated with such facilities must be offset by the disposal fees that can be charged and the energy revenues that can be derived from the sale of electricity or process steam. Therefore, the prevailing cost of landfill disposal in any area and the cost of power are very important in determining the economic feasibility of waste-to-energy facilities. Some of the major factors that must be considered in determining the feasibility of constructing waste-to-energy facilities in developing or transitional countries include:

- Landfill costs are often low in developing and transitional countries. However, the increasing complexity of landfill operations may provide sufficient incentive in the future to seek to reduce the amount of solid waste that will ultimately require disposal.
- The cost of power may affect the feasibility of waste-to-energy facilities since it is not likely that these facilities will derive unit revenue from selling electricity that is significantly higher than the rate at which it is sold to consumers.

- Municipal solid waste in developing and transitional countries usually has a higher level of organic waste with resulting higher moisture content. This may lead to a requirement that more supplementary fuel (oil or natural gas) is used to maintain the combustion process. In such facilities in North America and Europe, the high content of combustible non-organic components (and resulting decreased moisture content) allows the facilities to auto-combust (the ability to maintain combustion without the addition of supplementary fuels) the solid waste material burned. Increased use of supplementary fuel to burn high-organic waste increases the operational costs of such facilities. The solid waste composition and its variation must be closely evaluated to determine the feasibility of any waste-to-energy applications in Indonesia.
- Many formal and informal waste reduction efforts will have an effect on the extent of combustibles in the municipal solid waste stream. In one case, the removal of combustible materials such as paper, cardboard, and plastic may reduce the caloric value of the solid waste while the removal of non-combustibles such as metal and glass will have the opposite effect. The effect of these programs must be evaluated closely to determine their effect.
- The operation of technically complex systems such as waste-to-energy facilities requires the services of highly specialized personnel who are properly trained to assure that the facilities are operated in an environmentally sound and cost effective manner. Such personnel are not always readily available in developing or transitional countries.

In most countries where energy recovery incinerators have been built, the private sector has taken a major role in developing these projects. A waste-to-energy facility must be operated as a conventional power plant with a focus on the production of derived energy rather than on the disposal of solid waste. In the case of successful waste-to-energy facilities, the solid waste is considered as a fuel with properties that are not as homogeneous as those normally encountered in using conventional organic fuels such as coal, oil or natural gas.

Incineration is only a sound management practice under particular conditions. At present, these generally do not occur in solid waste management programs with limited capital and technical resources.

## F.8 Sound Practices – Landfill

Landfills are an indispensable part of any effective solid waste management program. This is the case no matter how effective solid waste recovery or processing is. The most efficient waste reduction, compost or waste-to-energy will leave some residuals that must be disposed of in landfills. Current practices in developing and transitional countries have ranged from uncontrolled open dumps to secure landfills depending of the particular circumstances in each locale.

There is a broad range between the technical and design standards that exist for industrialized country landfills such as those in the U.S. and the E.U. and the current disposal sites in many Ivorian communities. Sound disposal practice in Indonesia will not necessarily replicate U.S./E.U. standards. However, it should include the development and operation of controlled landfills that take into consideration site features aimed at mitigating environmental effects. To accomplish this, operational procedures must be used that are aimed at the safe disposal of solid waste in a **controlled** manner.

Disposal landfills throughout the world can be grouped into three general categories:

- Open dumps

- Controlled dumps
- Secure landfills

Disposal facilities in developing countries most often fall somewhere between open dumps and controlled dumps. Uncontrolled, open dumps are not a sound practice, but controlled dumps and secure landfills can provide effective disposal of solid waste within reasonable standards of performance and environmental protection. In addition, countries with well-developed landfill standards have gone through a gradual technology evolution to reaching their current regulatory requirements. While countries with emerging standards can learn from the process of landfill standard evolution in other countries, a gradual pace of improvement may be warranted because of the extent of change required and the limited resources available to accomplish that change.

Open dumps have the lowest initial capital investment and operating cost of the three basic types of landfills. Many open dumps start as controlled dumps and degrade due to lack of management and other resources. Due to the low initial costs of open dumps, and lack of expertise and equipment, these degraded sites are common in developing countries. They pose significant risks to human health and the environment, especially as municipal solid waste becomes more dangerous through the introduction of industrial-based materials as industry is developed in a community. (Fundamental to landfill considerations is the relative mobility of pollutants as they flow through the soil to pollute groundwater and, ultimately, groundwater use points such as wells. Organic chemicals often associated with industrial waste have been found to be the most mobile of pollutants escaping from unlined landfills.)

While open dumping is not generally considered to be sound practice, it may be acceptable for very poor countries where cities are near deserts such as some areas of North Africa and the Middle East. Managers are often compelled to close open dumps and construct controlled landfills as is the case in a number of the prototype communities. However, the impact and reality of inadequate financial, technical and managerial resources means that an attempt to change open dumping practices and gradually upgrade existing sites is often warranted. Section 8 of the manual presents the criteria for establishing a landfill operations plan. While a good operations plan is necessary for any new landfill facility, the criteria can also apply to the upgrade of existing sites to controlled operations.

Effective landfills require **active** management where all functions are controlled by dedicated staff and managers responsible for all activities at the landfills. Observations at a number of the prototype community landfills indicate that many of the sites are not actively managed through full-time dedicated staffs who work at the facility during all hours of operations.

Based on worldwide experience, there are a number of sound practices that have been defined for controlled and secure landfills, including:

- Leachate management and environmental impact minimization
- Gas management and risk reduction
- Access security
- Record keeping to document operations
- Waste compaction and daily cover
- Documented and effective operating procedures, and worker training and safety programs

- Establishment and maintenance of good community relations
- Closure and post-closure planning

The following information defines what generally accepted sound practice in some of the above criteria.

**Leachate Management** - Leachate management is a key element in landfill design and operation. The natural decomposition of municipal solid waste, in combination with rain infiltration into the landfill site, causes contaminants to leach and flow toward the bottom of the landfill where it can enter the soil beneath the waste accumulation. The wetter the climate, the greater the potential risks of groundwater and surface water contamination from the landfill since the contact between water and solid waste is increased.

Since leachate can be expected to be generated in any landfill setting, the characteristics of the soils directly beneath the landfill are extremely important. Low impermeable soils such as clay or silt can be moderately effective in treating leachate through a process called “natural attenuation”. As leachate flows through soil, physical and chemical processes help to treat the leachate. Natural attenuation processes are minimally effective in permeable soils such as sand.

A secure landfill contains engineering features such as impermeable liners to allow the collection of all leachate and prevent the release of pollutants to the environment. Natural materials such as clay or synthetic materials such as high-density polyethylene sheets are often used to line the bottom and sides of landfills. The design standard in industrialized countries such as the U.S. and the countries of the E.U. have adopted a composite liner standard where both recompacted clay and a synthetic liner are used together.

To minimize the production of leachate, cover material should be applied at the end of each day that the landfill is operated. When a landfill is closed, a final cover is applied to isolate the solid waste from further contact with precipitation and to minimize the production of leachate after closure.

In lined landfills, leachate is retained by the liner and removed by a leachate collection system which is installed above the liner. This system is important in not allowing the leachate to build-up over the liner to increase the potential of leakage through the liner. The system usually consists of a perforated piping system which collects the leachate and allows it to be transported to a storage tank or a treatment facility tank. Periodically, leachate must be removed from the storage tank and treated or disposed of. The most common leachate management methods are: discharge to a wastewater treatment plant, on-site treatment followed by discharge to sewerage or surface water (depending on the quality of the treated leachate), and recirculation back into the landfill. All of these options generally require a pumping system.

The state-of-the-art liners and leachate collection systems described above are often too expensive for many developing countries. There are a few leachate management practices that are much cheaper and may be practical in some situations.

- Municipal solid waste in an area with low rainfall can be partially dried at transfer stations (if they exist as part of the solid waste collection/transfer system prior to landfilling). This will reduce the leachate produced at the landfill.
- For areas where pre-drying is impractical or where the soils are permeable (and where leachate runoff would therefore be a major problem), it may be necessary to site a landfill in an area with a steeper grade than would otherwise be chosen. In conjunction

with a well-distributed leachate collection system, this can reduce the dangers of groundwater contamination. The actual grade required would depend on the hydraulic conductivity of the soil, the stability of the graded surface, and other site-specific engineering considerations. The use of steeper grades, along with the denser placement of leachate collection pipes, will add to the cost of a landfill. However, these changes may be far less expensive than constructing effective liners.

- To avoid the initial cost and ongoing maintenance requirements of pumping leachate, leachate can be collected in a lined holding pond that is constructed downhill from the landfill. In this impoundment, the leachate could be allowed to evaporate as much as possible.

**Landfill Gas** - Landfill gas will be generated as solid waste decomposes. The amount and chemical characteristics of landfill gas is a function of the type of solid waste placed in the landfill and the chemical/biological conditions maintained in the mass of solid waste in the landfill. Landfill gas is primarily a mixture of methane and carbon dioxide produced by the decomposition of the organic matter in the municipal solid waste. Landfill gas (methane) is highly flammable and poses a risk of explosion on and off site. Landfill gas can migrate through soil as the pressure increases in the landfill due to gas buildup.

Gas management is generally required at secure landfills as the accumulation of solid waste placed in the landfill increases. At controlled dumps, there should at least be gas monitoring to determine if dangerous amounts of gas are being released and migrating to locations where it can cause problems.

A low-cost design to handle landfill gas consists of buried vertical perforated pipes, using the natural pressure of the gas to collect and vent at the surface. This is called a passive collection system. More costly active collection systems utilize a buried network of pipes and pumping to collect the gas for flaring or combustion to generate electricity. There are general conditions that should exist to justify the capture and use of landfill gas. Fundamental to all this is the fact that there needs to be sufficient landfill gas available to justify the expenditure of installing an active gas system where the gas is captured for its energy value. This generally requires that a landfill has at least 1,000,000 tonnes of solid waste in place to generate sufficient gas.

**Access Security** - Landfill access features such as fences and berms should be designed to restrict unauthorized access to the landfill and to keep out stray animals. Ideally, a fence, wall or vegetative hedge should be planted along the perimeter of the site. Such structures can also assist in catching paper or plastic materials that become airborne because of windy conditions.

A staffed gate should be the point of entry to the facility for vehicles and any waste pickers. Ideally, the gate should be equipped with scales for the weighing of vehicles as they enter and exit the facility. This provides a record of the tonnage of material entering the facility. Weigh scales are an essential element of a sound municipal solid waste management system since they provide critical information for planning purposes and for operational management of collection vehicles. However, as is the case throughout the world, the size of the landfill may determine the economic ability to support the installation of features such as truck scales. In the case of the small to moderately-sized controlled dump (less than 200 tons per day), calibrated tables of weight-to-volume for delivery vehicles may be used to provide an estimate of the quantity of materials brought to the disposal area. Some monitoring of the amount received is a crucial sound practice since it provides important

information both to monitor the performance of the facility, to monitor the efficiency of the collection system and to plan future solid waste management practices.

**Work Face Operations** - It is useful to define and illustrate some common terms when discussing landfill operations.

A **cell** is the basic unit by which a landfill is developed. It is the general area where incoming waste is off-loaded from trucks, spread, compacted and covered. A basic cell consists of a base of synthetic or soil liner, compacted municipal solid waste and a compacted cover layer of soil. Cells range in height from two to three meters. Special cells

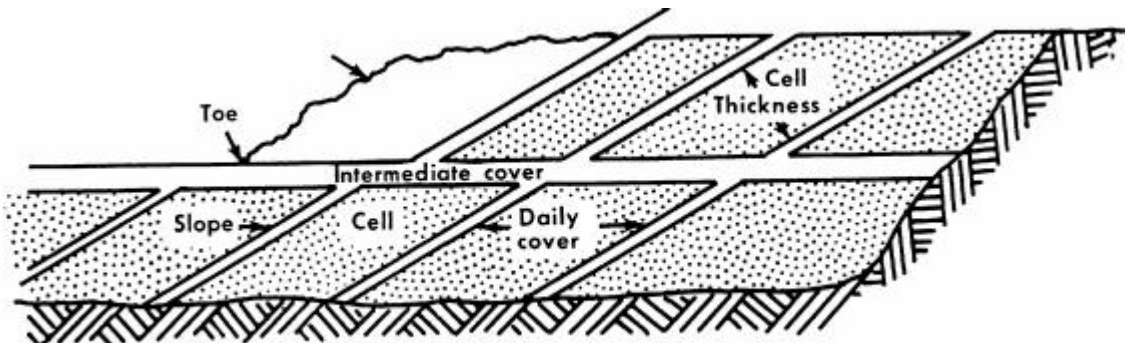


Figure F.1 - Typical Landfill Lift Structure

in the landfill may be reserved for materials such as medical waste or construction and demolition debris. The dimensions of a cell depend on 1) the type of equipment being used to deliver, place and compact the solid waste and 2) the dimensions of the overall site.

A **lift** is the completed layer of compacted waste in the cell. Municipal solid waste is laid down in rows 25 to 75 centimeters thick. This layer is then compacted either by multiple passes of a manual roller or a mechanical compactor. A second layer of waste is then spread upon the first and subsequently compacted. The process is continued until the desired height of the lift is attained. As noted above, this ranges from two to three meters. The completed lift is covered with a layer of soil that is 15 to 30 centimeters thick when compacted. This layer of cover is called intermediate cover. This completed lift and cover material constitute a cell. Compaction increases the capacity of the landfill. Mechanical compactors achieve densities of 500-900 kilograms per cubic meter. However, smaller landfills in developing countries may not be able to afford solid waste compactors. Other equipment such as rollers or bulldozers may be used for this purpose. They will generally not achieve the compaction densities of compactors.

The **working face** is the length and width of the row in which the waste is being deposited. The overall intent of controlled operations should be to keep the overall size of the work face at a minimum. This will help to decrease overall costs and increase the ability to control environmental effects.

As illustrated in Figure F.2, some landfills use multiple lifts. Thus, when one cell is completed, another is placed above it. This second level of cells is not begun until the first level is filled with cells at the same level. It is customary to stack cells into a final pyramidal structure. The final cell in the stack is covered with soil that is 60 centimeters thick when compacted. When stacked cells are employed, the final slope should be chosen to facilitate the runoff of precipitation while ensuring the stability of the structure. Examples of such a design from the prototype communities will be presented later in this manual.

To the degree possible, delivered solid waste should be dropped off at the working cell or work face. This requires the construction and maintenance of access roads to work face locations within the site. If this is not possible, tipping should occur close to the gate area and the load transported to the working cell by onsite vehicles or carts. In any case, the tipping and cell process must be actively managed if the cell construction is to be maintained at its smallest size. This is an extremely important element in operating effective landfill operations irrespective of the size of the facility. Observations at the prototype community disposal areas have shown that a lack of tipping location control creates a situation where waste becomes indiscriminately scattered throughout the disposal area with no means for controlling its effects.

**Materials Recovery at Disposal Sites** - Materials sorting at a landfill can be either an informal process through the activity of scavengers or formal if materials are separated for recovery or for composting. Generally, sorting and recovery should occur in a designated location away from the working cell. This helps to eliminate the basic safety conflict between the operation of mechanized equipment and informal scavengers. Activities such as recycling at the workplace can work against the goal of keeping the workplace area at a minimum size.

Access to a landfill should be restricted to trained personnel and municipal solid waste haulers. Landfill operations and machinery can pose dangers to untrained persons. Where waste picking is allowed or difficult to prevent, the process should be controlled as much as possible. If pickers nevertheless persist at landfills, licensing and cooperation between pickers and municipal staff can help to minimize problems. Allowing pickers access to secure facilities, and providing basic health services such as vaccinations for infectious diseases and tetanus, will reduce health problems. This approach has been followed in cities such as Bangkok, Cairo, and Seoul. Operating under a permit structure may provide greater control of scavenger activity by providing greater accountability to the landfill operations plan.

**Construction** - While construction is required for any new landfill site, it can also be expected that construction in some form will continue during the operation of the site. The amount and type of construction depends on the class of landfill and on physical conditions at the site. Construction will be required for:

- Access roads
- Erection of fences, gates, and the tipping area
- Site preparation for the diversion of precipitation and the control of runoff
- Installation of the leachate and gas collection, treatment and monitoring systems
- Administrative offices and other buildings at the facility
- Preparation of the general working area, including: land clearing, grading, and excavation
- Installation of liner